THE

ELECTRICAL REVIEW.

VOL. LXXIII. JULY 25, 1913. No. 1,861.

ELECTRICAL REVIEW.

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A WIRELESS ADVISORY COMMITTEE.

IN a long letter to the *Times* of Tuesday last, Prof. Larmor advances views on the subject of Imperial wireless communication which are worthy of more than passing notice. While disclaiming any special knowledge of the technical details of the various systems of radiotelegraphy, he strongly supports the proposal that the Government should itself construct the long-distance stations, and retain a free hand to use any system or any combination of systems that may be found most suitable for its purposes. Prof. Larmor admits that the Post Office staff is not at present equipped with the knowledge and experience required for this work, and appears to be more than doubtful as to the qualifications of the Admiralty to deal with the requirements of the future. Neither is there an adequate supply of men fundamentally trained in the principles of radiotelegraphy, though, in his opinion, the demand will create a supply by drawing competent men from other occupations,

Under these circumstances, Prof. Larmor puts forward the admirable suggestion that the Advisory Committee appointed in connection with the inquiry into the Marconi contract should be made permanent, strengthened by the addition of other eminent scientific men, and placed in relation to the Radiotelegraphic Department of the Admiralty and the technical engineering staff of the Post Office. The valuable assistance rendered to the Army Flying Corps by the scientific Advisory Committee on Aeronautics, which was appointed a few years ago, and has carried out important researches at the National Physical Laboratory, is cited in support of the proposal, which, moreover, would have the immense advantage of removing the problems of wireless communication from the floor of the House of Commons, where they have become the sport of party politicians, to the serene and impartial atmosphere of scientific investigation.

While the proposition on the face of things is highly to be commended, it cannot be denied that there are certain difficulties in the way of its achievement. Not the least of these is the heavy cost of practical research in long-distance work. Nothing can be accomplished without the possession of an experimental station, the cost of which alone could not be less than £50,000: the preliminaries would occupy at least six months, and the erection of the station would take a similar period, so that the practical research could not be commenced until fully 12 months had elapsed. Another year, at least, would be expended before an authoritative decision could be formed as to the very best system available *at that time*, for changes in the aerials, the towers, and the plant would necessarily involve a great deal of time and labour, so that the erection of the Imperial chain could not be begun for at least 2 or $2\frac{1}{2}$ years from the appointment of the Committee on a permanent basis.

It may be argued that the experimental station, when thus tuned up to concert pitch, would serve as the first Imperial station, but it would be of no use without the rest of the chain. Moreover, we are told by Prof. Larmor, Prof. Milne, and the Advisory Committee, that the rival systems are in course of rapid development, and we imagine that they always will be in that state—just as the incandescent lamp, the steam engine, the motor-car and the aeroplane have been, for many years—so that it is more than doubtful whether the Committee would be any "forrader" in two years' time than when it began its labours.

Now, it is, and for two years has been, constantly urged by our Naval and Military authorities, that the provision of wireless communication with the rest of the Empire is a vital necessity and a matter of great urgency; the Government has declared that the stations ought to be erected for

this reason alone, regardless of commercial considerations, which are of secondary importance. Other nations are taking steps to a similar end, and we shall soon lose the advantages of priority in the field, which include the free choice of site and wave-length, unhampered by the propinquity of foreign stations, together with the temporary advantage, in the event of war within the next year or two, that we alone would possess a world-wide wireless service. If, therefore, we are to accept the views of these authorities, endorsed by the Select Committee and approved by the House of Commons—and we must either accept them or ourselves assume the responsibility for the defence of the Empire—we must recognise the necessity of immediate action. Whether the present systems will be obsolete in a few years' time, or whether the best possible terms, from a financial point of view, have been arranged, or not, it is, as Mr. Samuel recently said, high time to make an end, and to proceed with the work. Mistakes in these matters can be remedied at leisure in the future; the one mistake that can never be remedied is the fatal one of *being too late*.

But apart from experimental research on the grand scale—which may be undertaken, but ought not to be allowed to delay the erection of the Imperial chain—there is abundance of scope for the services of such a Committee as that suggested by Prof. Larmor. Not the least useful of its functions would be to investigate exhaustively the merits of each system, and to advise the Government with authority as to its proper course, purely from a technical point of view. At present, as Mr. Samuel is careful to impress upon the House of Commons, he is guided entirely by his expert advisers on the technical aspects of the question; the opponents of the contract now under discussion are not disposed to accept without question the opinions of those advisers, but they could hardly presume to flout the views of a body speaking with the weight of competent technical knowledge and high scientific reputation. Whatever the merits of the systems put forward, we cannot too strongly protest against the treatment of the subject as a bone of contention between the rival parties, when as a matter of national and urgent importance it ought to be dealt with solely with a view to safeguarding the highest interests of the Empire.

Electrical Development in Germany in 1912.

A SURVEY of electrical progress was given by Geheimrat Christiani, president of the Verband Deutscher Elektrotechniker, at the general Conference of the Verband, which was held recently at Breslau. He stated, in the first place, that the spirit of enterprise in the electrical industry in 1912 was active, and the new promotions and increases in capital were considerably in excess of the average in recent years, whilst a similar observation was also applicable to the export trade. Proceeding to discuss technical questions, the president mentioned that there were no longer any special difficulties in the way of the transmission of high-pressure current by means of underground cables. An important event in the lighting department lay in the reduction in the prices of wire lamps, and electric cooking and heating increased in consequence of the introduction of lower tariffs. The endeavours made to extend electrical working on the railways were exceptionally noteworthy, the most important relating to the scheme for the conversion of the Berlin City and Circle railways. On the other hand, the number of electric motor-coaches was increasing and an expansion was also taking place in the use of electric motor-cars. The employment of accumulators in submarine boats, for wireless telegraphy, and for railway traction, also contributed towards the larger demand experienced by makers. The principle of reducing the cost of electrical energy was the basis upon which the use of electricity in mining and in iron and steel works was being built up, and in this connection the president submitted that Germany held the lead in the production of electric steel. After referring to competitions for miners' electric lamps, the president concluded by mentioning the introduction of underground telephone cables; the first of these has been laid between Berlin and Rhenish-Westphalia, and the section from the capital to Magdeburg has just been completed.

The Consequence of Negligence.

IN these days about half the time of the judges of the King's Bench Division is occupied in trying cases involving charges of negligence. That there is so much negligence in the legal sense of the term is largely due to the fact that people are ignorant of their rights and liabilities. In a recent case, the Court may seem to the uninitiated to have come to the conclusion that those who hire out articles are virtually in the position of insurers, but it is important to notice that this proposition only holds good if the hirer knew, or ought to have known, of the potential element of danger. It was the case of White *v.* Steadman, in which Mr. Justice Lush gave judgment on May 26th. The male plaintiff hired a landau and horse from the defendant, a livery stable keeper, for the purpose of taking a drive. The female plaintiff, the wife of the male plaintiff, was one of the party who went in the carriage. The defendant provided the driver as well as the horse and landau. During the journey the horse showed considerable signs of restiveness, and on the way back it got out of control in passing a traction engine, shied, and the carriage was upset, both plaintiffs receiving injuries in respect of which they sued the defendant for damages. The jury found that the defendant knew, or ought to have known, if he had used proper care, that the horse was not safe at the time the landau was let out to the male plaintiff. It was held that the defendant was liable in damages not only to the male plaintiff, but also to the female plaintiff, first, because a person who lets out an animal which he knows or ought to know is dangerous is under a duty to warn not only the person who hires it, but any person who he knows or contemplates or ought to contemplate will use it, such duty existing independently of contract; and, secondly, because the defendant who kept control of the landau accepted the female plaintiff as a traveller or passenger, and was, therefore, bound to use due care to see that she was safely carried.

The whole point in the case is that the jury found that the defendant knew, or ought to have known, that the horse was vicious, otherwise the defendant could not in the circumstances of the case have been held liable. Applying this principle to machinery, it is clear that if a man were to hire out a machine which he knew was defective and injury was caused to someone, he would be liable but not otherwise.

Absorption of Wireless Radiations.

MANY hypotheses have been advanced to account for the fact that the range of transmission from a given wireless telegraph station is generally so much greater by night than by day. The first explanation suggested—probably the one which has enjoyed most popularity—was that sunlight produced a deeper "layer of ionisation" in the upper parts of the atmosphere, and, by rendering this layer more or less conducting, increased the absorption of the radiations and thus decreased their effective range. This explanation, though sufficiently plausible at first sight, becomes less convincing when it is remembered that the difference between day and night ranges is less marked in an east and west direction than over a north and south route. On the other hand, tests referred to later indicate that this difference is not so great as has been claimed by some observers.

During the past few years, the United States Navy Department has been investigating the problem, and from the results recently announced by Dr. L. W. Austin, it appears unlikely that ionisation by sunlight is the true explanation of decreased daylight ranges of transmission. In the first place, the ground absorption over certain routes when working with certain waves is over 20 times as great as though the transmission were over sea water, yet on some nights this excessive absorption practically vanishes, and it can hardly be contended that the absence of the sun's rays is responsible for this change. Again, during the recent arc tests at Arlington, it was discovered that certain wave-lengths were transmitted very much better than others. For instance, if reception were weak when using a 4,100-m. wave, changing to 3,950 m. would almost invariably result in

excellent reception ; and *vice versa*. In other words, there appears to be a selective absorption in action, and there can be little doubt that interference occurs between one train of waves travelling along the earth's surface and another train reflected from the conducting upper layers of the atmosphere. This hypothesis was first advanced by Dr. de Forest. By calculation it appears that the height of the reflecting surface would be from 40 to 60 miles, at which level conductance would be appreciable. The fact that the above phenomenon is not observed when using the spark system, is due partly to the short wave trains of the latter (making impossible any interference), and partly to the coarser wave adjustment employed in the spark system and the consequent impossibility of ascertaining the effect, beneficial or otherwise, of small changes in wave lengths.

We are thus led to the conclusion that at night the upper layers of the atmosphere are stratified so that, at a height varying from time to time, there is a sufficiently abrupt change in conductivity to make possible reflection and hence direction of additional energy to the receiving station. By day, owing to the more or less irregular ionisation produced by sunlight and owing to vertical convection streams, no such regular stratification is possible. The better results at night are due not to decreased absorption, but to the increase, by reflection, of the radiation received at the distant station. Where undamped wave trains are used, a small change in wave length gives greatly improved results by removing interference between the direct and reflected waves.

According to Mr. Marconi, reception at Glace Bay from Clifden is as good, or even better, by day than by night. Certainly the difference between the day and night transmissions is less marked in the case of radiations of long wave lengths, but the Navy Department's tests at Arlington (2,840 miles from Clifden) and Brant Rock (2,460 miles) showed much better reception of the Clifden 7,000-m. waves by night than by day. During the autumn and winter 35-55 micro-amperes were received by day at Brant Rock through a resistance of 25 ohms, but at night the current frequently exceeded 100 micro-amperes. During the summer the current received by day was from 7 to 12 micro-amperes, the signals being faint and often inaudible ; by night much better results were secured. Similar results were obtained at Arlington.

The Italian Electrical Industry.

ACCORDING to a communication from Milan, the Italian electric manufacturing industry is labouring under two disadvantages at the present time. The first relates to the tardy settlement of accounts, both by private customers and by public authorities, and the second concerns the prevalence of keen competition, owing to the absence of agreement among the makers, thus causing depression in prices. The production of dynamos, motors, and transformers has made decided progress in recent years, and the export of small sizes has already been commenced, whilst the cable branch has been largely developed, and the quantity of cables exported in 1912 exceeded £280,000 in value.

Apart from the work proceeding on new hydro-electric stations in different parts of the country, and extending in various cases over a number of years, a partial standstill has been reached in regard to the promotion of entirely new schemes of this kind, although existing supply works are increasing their connections as far as is possible under present circumstances. The stagnation in new projects is due to the abundance of hydro-electric undertakings already carried out or still in progress, the effects of the economic crisis, and the reserve manifested by investors with respect to participating in industrial enterprises of all kinds. Nevertheless, the average dividend paid by 29 supply companies has risen from 6 per cent. in 1911 to 6·3 per cent. for 1912. It is expected that when the general economic crisis has been overcome, a development in new hydro-electric works will again take place, especially in the South, where large schemes are projected, and that electric railway work will also proceed at a greater speed than in recent years.

Lead.

THERE continues to be no abatement of the strong underlying conditions of the lead market, although prices fluctuate a little on occasion from local causes. The predominant feature is still the shortness of supplies coming to hand, and the exceeding probability that the scarcity will continue for some time yet, since the troublous state of things in Mexico continues without any abatement. When our imports and exports over the first half of the year are taken into consideration, the net result is that the total available for the home trade is less by nearly 9,000 tons than it was last year, and promises to be short for the rest of the 12 months. There is quite a fair demand for material from day to day, and it is clear that the export markets are not too well supplied, for there is a steady run of buying from Russia and some other important consumers. Where lead is wanted for early delivery, pretty stiff premiums have to be paid. The annual returns of the Metall-gesellschaft, of Frankfort-on-Main, have now been issued, and these, as suggested recently in our columns would be the case (June 13th, p. 966), indicate a reduction in the Mexican output for last year. The actual Mexican production of soft lead is estimated at 120,000 metric tons, a falling off of 4,600 tons, while, when the exports from Mexico to the United States refineries are considered, a further falling off of 6,700 tons is seen, the United States production from imported silver-lead from Mexico being 69,700 tons, compared with 76,400 tons in 1911. With a world's production of 1,189,100 metric tons, against 1,132,900 tons in 1911, the increase amounts to 5 per cent., while over the past ten years the average increase works out at 3·5 per cent. The following returns show the world's production in metric tons :—

	1909.	1910.	1911.	1912.
Spain	184,000	191,900	175,100	186,700
Germany	167,900	159,900	161,300	165,000
France	26,900	20,200	23,600	33,000
Great Britain	28,200	29,600	26,000	29,000
Belgium	40,300	40,700	44,300	57,100
Italy	22,100	14,500	16,700	20,500
Austria-Hungary ...	14,000	17,500	19,600	21,400
Greece	15,300	16,800	14,300	14,500
Sweden and Norway ...	200	400	1,100	1,300
Russia	800	1,200	1,000	1,000
Servia	1,400	—	—	—
Turkey in Asia	12,100	12,700	12,400	12,500
Europe total	513,200	505,400	495,400	542,000
United States	349,500	369,400	377,900	386,700
Mexico	118,000	120,700	124,600	120,000
Canada	20,800	15,000	10,700	16,300
North America total ...	488,600	505,100	513,200	523,000
Japan	3,400	3,500	4,200	4,500
Australia	77,200	98,800	99,600	107,400
Other countries	5,800	15,700	20,500	12,200
Total production ...	1,051,000	1,128,500	1,132,900	1,189,100

The world's consumption is as below in metric tons :—

	1909.	1910.	1911.	1912.
Germany	213,200	210,400	229,800	220,500
Great Britain	202,700	208,400	198,300	196,100
France	102,300	89,800	99,600	106,500
Russia	38,400	48,800	43,100	45,600
Belgium	43,600	32,000	53,600	50,800
Italy	31,400	28,200	36,300	32,000
Austria-Hungary ...	31,000	31,500	36,200	37,900
Holland	5,900	6,500	6,800	6,300
Switzerland	5,300	5,900	5,000	6,400
Rest of Europe	4,000	4,300	3,500	4,400
United States	339,900	378,900	365,200	397,800
Canada	21,400	17,800	21,100	30,000
Japan	11,900	16,500	18,900	24,500
Australia	4,900	7,200	9,100	10,100
Elsewhere	23,800	30,200	31,200	30,000
Total	1,079,300	1,116,400	1,157,700	1,198,900

The increased consumption during 1912—41,000 tons, is just about accounted for by the increase recorded in North America—32,600 tons in the United States, and 8,900 tons in Canada.

D

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

About 12 months ago the writer recounted some of the breakdowns on the transmission lines which supply the Toronto Electric Light Co. and the Toronto Street Railway Co. with current, whereby industries were on several occasions without power, street and house lights were out, and the trams were motionless.

This year it is the turn of the Hydro-Electric Power Commission to suffer. Three times within a month all power has been off the whole of the Commission's system for several hours at once in every case. The seriousness of such a state of affairs may be imagined when it is remembered that some 40 different cities, towns and villages derive their power and light principally, and in very many cases almost entirely, from this source, the maximum daily summer load averaging about 26,000 H.P.

The trouble appears to lie entirely in the failure of insulators, which has suddenly and without warning taken place in a wholesale manner, and the situation is rendered much worse than might have been expected, as the failures have occurred on the section which is in duplicate, and both lines have been put out of operation simultaneously.

In the province of Alberta, where there is a Government system of telephones, it is proposed to spend over two million dollars this year. Two thousand four hundred miles of wire will be strung on rural lines alone.

The town of Saskatoon, Saskatchewan, is in need of additional electric power, and three schemes are at present being considered.

MUNICIPAL HIGH FINANCE.

By "CYNICUS."

I had just been appointed engineer and manager of the Blanktown Electric Tramways, and, this being my first chief's job, I was determined to do well. Everyone knows that this system had the reputation of being one of the best managed municipal undertakings in England, and that it regularly for some years past had handed over £50,000 per annum for the relief of rates.

The day after my appointment I was called before the Borough Council, and the chairman proceeded to read the following from some newspaper (I seemed to have read the nonsense somewhere myself): "Municipal tramways and those owned by companies are on an entirely different footing. Whereas the latter must endeavour to make profits for the benefit of its shareholders, the former should not. A large sum regularly contributed to the relief of rates simply means that the tram-travelling public are paying the rates, to the exclusion of the owners of private conveyances. The working man is paying more than the wealthy capitalist, an intolerable state of affairs."

"That," exclaimed the chairman, "is what we got rid of our last chap for."

I left the Council Chamber a saddened man, but determined to do what was expected of me. I accordingly reduced all fares 25 per cent., but, to my horror, found this merely induced more people to ride, and so popular did our service become, that at the end of my first year there was a surplus for relief of rates of £60,000.

This clearly would not do, so I introduced ½d. fares. Everyone who reads the technical journals knows that these are sure to bring ruination. But so perverse were the Blanktown people, that they now simply swarmed on the cars; we did not even have the usual mid-day slackness, and, to my shame be it said, the result of my second year's management was a surplus of £75,000.

I was called before the Council and given to understand that I was on my last chance, but that I could have one more year to atone in. Curiously enough, I received, the same day, a highly eulogistic letter from the Chairman of the Ratepayers' Association.

I now set about matters at the other end. A circular was issued, intimating a rise of 20 per cent. in wages all round. The senior motorman waited on me, and reeled off a speech that had been carefully written for him and learned by heart. When he came to "And we shall all endeavour, by strictest attention to work, to merit your munificent generosity. We shall practise economy in every detail," I stopped him and warned him that any such behaviour would lead to instant dismissal.

Conductors were granted a bonus of 3d. for every genuine case of overriding discovered and 6d. for every fare completely missed. Motormen using over 1½ units per car-mile were specially rewarded, and they were all taught that the first "nick" of the parallel was the proper one to drive on.

We also had the good fortune during the year to have several big accidents, involving the payment of heavy compensation. This, however, could hardly be attributed to sheer luck, for we encouraged motormen to come on duty in an intoxicated condition.

My efforts were crowned with success, and at the end of the year I was able to show a debit balance of £315. I was called before the Borough Council, warmly thanked, and given a substantial increase in salary. But now the Ratepayers' Association is clamouring for my dismissal. It seems to be impossible to please everybody.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Mutual Protection of Engineers.

Are there any, other than those advertisers who for some reason best known to themselves, wish to withhold their names from the light of publicity—who do not fully endorse the views so well submitted by "Vertebra" in a recent issue?

That one should be obliged to give the fullest details of his career to some unknown advertiser, and to state the salary for which he would undertake the duties of a post, any real and guiding particulars of which are seldom afforded in the majority of advertisements, is not only a waste of time and expense to 70 per cent. of the applicants, but is equally useless to the advertisers.

Will the advertisers who consistently, or even occasionally, hide themselves behind box numbers, take the opportunity of expressing their reasons for so doing to the many who wish for enlightenment in this connection, before organised boycott is entered upon?

P. O. W.

"Light and Illumination: Their Use and Misuse."

I have read with interest the comments in your issue of July 11th, with respect to the booklet reprinted from the *Illuminating Engineer* under the above title.

I am, of course, prepared to admit that finality has not been reached in the reproduction of lighting effects in illustrations. Anyone who has had experience of taking photographs by artificial light will agree that the problem is a very difficult one, and it is only recently that attempts have been made to give a faithful picture of artificial lighting conditions in this way.

Special skill is needed to take photographs by the light of incandescent electric lamps, showing figures of people, on account of the considerable exposure entailed, and this, no doubt, explains the darkness of the surroundings in several of the illustrations from the American publication to which you refer. At the same time, I should like to point out that it is now possible for a skilful photographer to take photographs by artificial light, which show the conditions of illumination quite satisfactorily for all practical purposes.

Another matter to which you refer is the successful use of the non-glossy ink and unglazed paper. The reproduc-

tion of half-tone blocks in these circumstances was somewhat difficult, and some experimenting was necessary before we were able to get what we venture to think a satisfactory result in this new field.

It may sometimes be desirable to accentuate some detail in the photograph in order to make a point absolutely clear. For example, we find that in order to emphasise the concentrating effect of the shadow it is often necessary to work in a cone of light underneath the opaque reflector, which the eye cannot, as a rule, see. People who are unfamiliar with these matters have sometimes not enough imagination to picture the rays of light being directed downwards, unless the rays are actually shown in the illustration.

I appreciate your remark that such work is of national importance, and it may interest you to know that a similar publication, in which the text is substantially the same, but the illustrations are applicable to gas, has lately been issued, and has been widely circulated by the British Commercial Gas Association. We understand that the Electric Publicity Committee also proposes to give publicity to this reproduction. In this way uniformity in recommendations on illumination should be obtained—a matter of considerable importance to the lighting industry.

L. Gaster,
Editor of the "Illuminating Engineer."

London, S.W., *July 18th*, 1913.

Are Hertzian Waves Injurious?

In the leaderette in your issue of July 11th you quote the *Elektrotechnische Zeitschrift*, saying that radio-telegraphists are subject to anæmia, a deficiency of red blood corpuscles and their haemoglobin contents.

You go on to state that it is not unlikely that the ozonisation of the air round about high-frequency apparatus has an injurious effect. Now, it is a well-established fact in therapy that pure ozone has quite the contrary effect. Ozonised air is used extensively by medical men, especially on the Continent, for the cure of anæmia, because it has a tonic effect on the red blood corpuscles, increases the appetite and tones up the system generally. It is also employed for relief of asthma, bronchitis and other complaints of the respiratory tracts, as well as for heart weakness, and lately, also, for consumption. It is a *sine quâ non*, however, that the ozone must be pure. This purity cannot be achieved when the ozone is generated by any form of disruptive spark, because the heat of the spark in the air produces oxides of nitrogen; these are the harmful constituents of ordinary manufactured ozone, such as is produced by high-frequency apparatus, and there is no doubt that these are responsible for the malady to which radio-telegraphists are alleged to be subject. All the earlier ozone generators had the defect that the ozone was adulterated with oxides of nitrogen, and most of these machines have disappeared. We believe we were the first to produce an apparatus which generates pure ozone, and this has been established by careful chemical analysis.

Ozonair apparatus are recommended by medical men for the alleviation of the aforementioned complaints, and have been installed in cliniques, &c., in all parts of the world. Not a week passes but we receive a visit or telephone call from a medical man or one of his patients, asking us to send an Ozonair apparatus for a case of illness. This proves conclusively that it is not the ozone which is dangerous, but the conditions under which it is manufactured.

Ozonair, Ltd.,
V. ZINGLER, *Manager.*

London, S.W., *July 17th*, 1913.

Rubber Prices.—Mr. C. Williamson Milne, presiding at the meeting of the KEPITIGALLA RUBBER ESTATES, said that a great many factors were operating which ought to make for better prices before very long. The Rubber Growers' Association recently made representations to the Admiralty with regard to the specifying of plantation instead of Brazilian product in Government contracts.

PROCEEDINGS OF INSTITUTIONS.

The Use of the Electrostatic System for the Measurement of Power.

By C. C. PATERSON, M.I.E.E., E. H. RAYNER, M.A., M.I.E.E., and A. KINNES, B.Sc., A.M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *May 1st*, 1913.)

THE authors have used the electrostatic system for all their alternating-current measurements at the National Physical Laboratory for upwards of six years. The instruments consist of electrostatic voltmeters and an electrostatic wattmeter, together with supplementary apparatus which enables commercial alternating-current instruments of any range and of the highest precision to be calibrated with ease and certainty. The accuracy attained is considerably better than five parts in 10,000; and the long experience gained in the everyday use of the instruments has convinced the authors of the great value and convenience of the system in the work of a central testing laboratory. There is no suggestion that the electrostatic wattmeter should take the place of any of the existing precision instruments used in station work—for this purpose it would prove troublesome—but where a system is required of the very highest accuracy, combined with a wide range of application and convenience in use, the authors are of opinion that at present there is none to be compared with the electrostatic system.

The primary advantage of the electrostatic system lies in the wideness of ranges of both current and voltage over which a single standard instrument can be used. The authors at present go up to 3,000 amperes in alternating-current power measurements; but if there were a demand for tests involving larger currents, it could readily be met. The voltmeter and the wattmeter require but a minute capacity current, and eddy currents do not arise in the apparatus to affect its accuracy under any circumstances met with in practice. The instruments are independent of changes in frequency or in wave-form, are all of the direct deflection type, and their scales can be read easily and accurately with the naked eye.

The chief disadvantages of the system are the relatively small controlling forces in the electrometers, causing the slow movement which is common to most electrostatic instruments; a pressure drop of 1 or 2 volts is wanted whatever be the current through the series resistance; and the instruments are not portable.

Only two electrostatic instruments are really necessary—a voltmeter and a wattmeter. Current is measured by the voltmeter used in conjunction with non-inductive resistances. The two instruments are set up near the centre of a semi-circular darkened enclosure.

The voltmeter is a 160-volt standard horizontal-type Kelvin and White multicellular instrument, with oil damping. Above the oil damper is fixed a concave mirror 20 mm. in diameter, which must be very accurately made. Its radius of curvature is approximately 3 metres. The beam of light from a Nernst lamp and lens is reflected from it, forming an image of the lens and crosswire on a scale, 4 m. away and 8 m. long, which forms the boundary of the enclosure. The voltmeter is the link which connects the system to the fundamental standard of voltage, and everything therefore depends on the accuracy with which it can be read and relied upon. The great length of scale and the sharp definition of the image of the crosswire on it enable the voltage to be read to an accuracy of 1 part in 10,000; the subdivisions marking each hundredth of a volt are about 1 mm. apart. It is easy to read to less than one-hundredth of a volt.

On account of the elastic fatigue of the suspension, and consequent slow creep of the deflection, the instrument has to be capable of being calibrated whenever desirable at the point at which it is being used. The calibration is done on continuous current by a simple potentiometer dividing-box, the instrument being reversed to eliminate the contact difference of potential. The voltmeter has been found very reliable, and in conjunction with a non-inductive resistance it enables the electrostatic wattmeter to be calibrated on alternating instead of on continuous current.

The wattmeter has a similarly extended scale; but as the law of the instrument is linear, an accuracy of 1 part in 10,000 is only possible towards the top of the scale. Its calibration is dependent on that of the voltmeter, and the highest accuracy obtainable must, therefore, be regarded more nearly as 2 parts in 10,000. It requires care to get an alternator to maintain as steady a voltage as this, and it is essential that the power should be supplied to it from a battery.

When the wattmeter has been calibrated in the above manner it is ready to be used on the testing circuit. A potential difference proportional to, and in phase with, the current in the circuit is put across the quadrants, and the pressure of the circuit, or a fraction of it, is applied between the needle and the quadrants. The instrument then correctly indicates the power in the circuit, and is independent of frequency or power factor.

The wattmeter is of the quadrant type, and is quite simple in construction. It is essential that all the parts shall be accurately machined, as it has often been necessary to take the instrument to pieces and to put it together again in such a way that the adjustments are unaffected.

The needle and quadrants are made of a special copper-aluminium alloy; this material has the greatest strength of the alloys of this series, and permits, therefore, of the use of a very thin needle. Each set of four quadrants is fixed on to a rigid brass plate, and is insulated from it by means of amberite pillars—three to each

quadrant. The diameter is 12 cm., and the slots are 0·5 mm. wide.

The moving system consists of a phosphor-bronze strip 20 cm. long, soldered to an upper connection, and at the lower end to the frame carrying the mirror. The frame is extended in the form of a long rod about 1 mm. diameter, which ends in the usual form of right-angled square-section hook. The hook engages with the lower rod, in the centre of which the needle is clamped between flanges. The mirror is concave; it has a radius of curvature of 3 m., and is 20 mm. high × 8 mm. wide.

The making of the needle requires great care. The needles are 50 mm. across and of the shape shown in fig. 1; the thinnest metal foil which could be used for the needle without bending under its own weight was 0·06 mm. The time of swing was reduced and the damping greatly improved by using thinner foil and pressing a fluting round the edge. The natural time of swing was reduced to 8 seconds, and the damping was made so that the moving system came practically to rest in 1½ complete oscillations. Foil 0·015 mm. thick was adopted. In practice the potential difference between the quadrants is about 2 volts, and between the needle and the quadrants 100 volts.

When the quadrants are connected to the terminals of a low resistance, the instrument measures the power which is being dissipated between the point to which the needle is connected and the point which is midway between the terminals of the low resistance (fig. 2). That is to say, the watts in half the main-circuit resistance are included in the power measured, and a correction for this must be made. If, however, the middle point of the resistance is accessible, the voltage-circuit can be connected so that no correction is necessary.

FIG. 1.—WATTMETER NEEDLE.

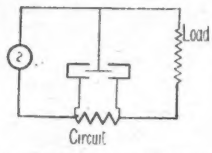


FIG. 2.—DIAGRAM OF WATTMETER QUADRANTS AND NEEDLE ON CIRCUIT.

The wattmeter has arrangements which permit of a quick determination of its constant at any point of its scale, in the same way that the electrostatic voltmeter is provided with a calibrating circuit which enables the scale error to be determined at any time.

In the larger part of the work with the wattmeter, fictitious loads are used. The current for an instrument is obtained from one source, and the potential difference for its voltage coils from another. The most convenient and usual way is to obtain these from two similar alternators whose armatures are coupled together, but one of whose fields can be rotated in relation to that of the other. In this way any required phase displacement can be

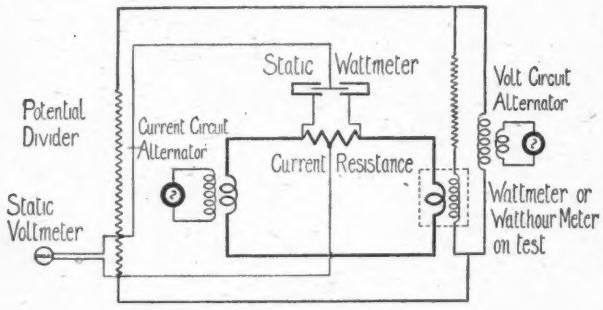


FIG. 3.—CONNECTION OF THE STATIC WATTMETER TO THE TEST CIRCUIT FOR THE CALIBRATION OF ANOTHER WATTMETER.

obtained between current and voltage; and separate adjustments for both are secured by means of regulating resistances in the two alternator fields. Fig. 3 gives, in elementary form, the connection of the wattmeter to the ordinary test circuit for the calibration of a wattmeter or a watt-hour meter on a fictitious load. It will be seen that the voltage and current circuits are interconnected at the subdivided end of the potential divider and the middle point of the current resistance. A potential divider is generally used so that the wattmeter can be worked with approximately 100 volts on the needle. The dividing resistances used by the authors consist of two boxes, each containing 100,000 ohms of Duddell-Mather woven resistance subdivided into sections which can be used on circuits up to about 12,000 volts. The resistances are divided into five parts of 20,000 ohms each, one of which is subdivided into 10 parts of 2,000 ohms. This arrangement permits of the choice of a large number of ratios without excessive subdivision of the resistance.

One of the great advantages of the wattmeter is the ease with which it can be used for three-phase measurements by the two-wattmeter method up to any current range.

The various switch arrangements are entirely automatic, the instrument being changed over in a moment from one phase to another without any disturbance of the circuit. In making, for instance, a two-minute test run on a watt-hour meter it is possible to take three wattmeter readings on each phase, changing over the instrument after each reading.

The voltmeter scales are calibrated by applying a known continuous voltage to the instrument by means of a potential divider. The best way of marking off the divisions of the long voltmeter scale, preparatory to the final drawing, is to consider some point at the middle of the scale (say, at 90 volts) as a datum point. After marking this off, the various voltages are marked on either side of 90, taking them alternately above and below so as to eliminate as far as possible the effects of "creep," and returning to the 90-volt point between each reading. The plan of always returning to the instrument zero between deflections was not found satisfactory.

As surface leakage over ebonite, due to the production of acid, has given considerable trouble, and a voltage of 260 was to be the normal pressure on the resistances, special precautions were taken, first to avoid leakage, and, secondly, to detect it easily if it occurred. The principle of breaking the leakage path by a conductor whose insulation from the resistance coil can be checked at any time affords a method of avoiding errors due to leakage. With the ordinary construction of resistances such errors, when they exist, are most difficult to detect.

The accuracy of the whole instrument depends on the proper adjustment of the resistance used for the Weston cell, so that its ratio to the sum of all the resistances of the box shall have the correct value. This can be done by using 16 equal 10-ohm resistances connected as shown in fig. 4. Their resulting value is 1·018518; which is the nominal value of the Weston cell at about

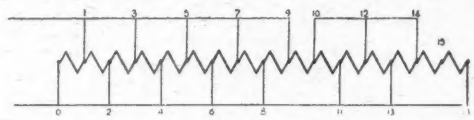


FIG. 4.—METHODS OF CONNECTING THE DIVIDING BOX RESISTANCES FOR THE ACCURATE ADJUSTMENT OF THE RESISTANCE USED TO BALANCE THE VOLTAGE OF A WESTON CELL.

16·5° C. instead of at 17° C. These connections being made, the combination is arranged as the unknown resistance in a Wheatstone bridge of suitable sensitivity; and balance is then obtained. The "cell" resistance is then substituted for the combination, and is adjusted until the bridge is balanced at the same value. By this means the cell resistance has automatically the correct ratio to the main resistances without any dependence whatever on the accuracy of any of the bridge coils.

The method of measurement of current described below is due to Campbell, and is mainly intended for the measurement of large alternating currents above 500 amperes.

A step-up transformer with a ratio of 1 to 100, or 1 to 200, has its low-voltage primary circuit connected across the terminals of the standard resistance which carries the current to be measured. The potential difference across this resistance is from 1 to 2 volts. The electrostatic voltmeter is connected across the secondary of this transformer, and its indications are proportional to the current in the standard resistance. The fact that the electrostatic voltmeter absorbs no energy ensures that the magnetising current of the transformer is very small. Used with an open-circuited secondary in this way the magnetising current is of the order of 0·02 ampere, and, being nearly at right angles to the impressed voltage, its shunting effect is negligible for resistances having a drop of 2 volts with a current of 50 amperes.

Unfortunately, the authors have found that when a transformer is used in this way, its ratio, instead of tending towards a constant value as the frequency is increased, continues to rise; it follows from this that its ratio will be dependent on the wave-form. The reason for this is mainly the self-capacity of the secondary winding. A way was found of neutralising the effect of this capacity by putting a very small load on the secondary winding.

The important factor in the transformer to be determined to a high degree of accuracy is the ratio between primary and secondary volts at the different frequencies at which the transformer is to be used.

The characteristics of the transformer have been determined when connected up as used in practice, *i.e.*, with the primary connected to a resistance giving a drop of 2 volts, and with the small secondary load compensating for the capacity, using a wave-form approximating closely to a sine curve. The accuracy of the determinations is much higher than is required, but a knowledge of these characteristics has been found of value when using the instrument for measurements of other kinds, and for these purposes a greater accuracy is often wanted.

The authors have experienced so much trouble with ebonite used in their electrical apparatus that a renewed warning on the subject may not be out of place.

In the use of electrostatic instruments for measurements of the highest precision the greatest care must be taken when ebonite is used as an insulator, particularly when it is exposed to strong diffused light. Deterioration due to light is accompanied by such a large drop in the resistance of the surface of the material that it may at times be regarded rather as a conductor than an insulator. The only way which the authors know to avoid the trouble is systematically to wash all exposed ebonite with soap and water.

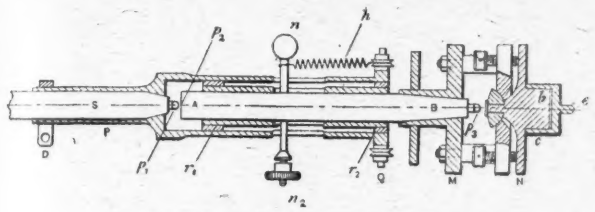
The principle now adopted is that unless the ebonite used in an instrument is well screened from the light it must not be looked upon as an insulator. Wherever possible, terminals passing through exposed ebonite are bushed with amberite.

The correct curve for the scale is horse-shoe shaped, being farthest from the mirror when the deflected and incident beams are in the same vertical plane; it rapidly approaches the mirror when the deflection is considerable.* Satisfactory results depend on the possibility of obtaining mirrors of very great perfection of form and of considerably longer radius of curvature than those usually supplied for instrument work. Such mirrors have been obtained from Mr. H. W. Sullivan, and give excellent definition.

A Nernst lamp forms a most suitable source of light.

An Electrical Measuring Machine.

IN a paper read before the INSTITUTION OF MECHANICAL ENGINEERS last month, Dr. P. E. Shaw described the latest form of his electrical machine for the accurate measurement of end-gauges of length. The machines hitherto employed for this purpose, while serviceable under ordinary conditions, are unsuitable for use in the standardising work of a metrological laboratory, being incapable of effecting a critical examination of the best modern gauges such as those of Johansson. The author's first machine was made in 1905, and has been used in the National Physical Laboratory since 1909. The new machine has a higher order of reliability than the earlier one, and a wider range of adaptability.



SECTION OF A MEASURING END.

The machine consists of a heavy cast-iron bed, on which travel two headstocks and a gauge-holder. The latter provides for the accurate adjustment of the gauge in position with regard to the bed, and for its movement between the measuring ends, so that every part of the ends of the gauge can be measured without risk of introducing error by the displacement. Each head-stock is provided with a "measuring end," a micrometer screw and a reading microscope. The accompanying illustration shows one of the measuring ends. In the older machine direct electrical contact was made between the point p_1 and the gauge; in the present machine, if point contact is to be made, one either uses the extreme point e or the point p_3; in the latter case the end piece M N is pulled off the bar A B. For most purposes p_3 is better than e for point contact. If, on the other hand, we wish to measure with flat ends, the end cap c is pulled off, leaving the lapped flat surface b at the extreme end. The brass tube P Q is coned to fit the screw spindle S, so that when pushed on the latter and the clamp D adjusted the whole forms a rigid system. The invar bar A B is made a true fit in the ebonite bush rings r_1 and r_2, and is prevented from rotating on its axis by the cross pin n n_2, which slides in the slotted brass tube. The end of A B is coned, and the coned end of the fitting M N is pushed tight on A B, the two parts being ground to fit. By means of adjusting screws the end surface b can be brought into a plane perpendicular to the line of the bed. A spring h controls the system and keeps the contact points p_1 and p_2 about ½ mm. apart normally; S is the invar shaft of a micrometer screw. Suppose this screw is advanced to cause the end of the system to meet a gauge surface on the extreme right beyond e. First e meets the gauge, then, as the screw is farther advanced, contacts p_1 and p_2 are brought together. The meeting of p_1 and p_2 completes an electric circuit consisting of a high resistance (say, 5,000 ohms), a cell, switches and telephone. As soon as the telephone sounds, the observer reads the divided head of the micrometer screw. On reversing the micrometer screw the spring h comes into action, breaking contact p_1 p_2, and the telephone again sounds.

It is most important to have clear sounds made in the telephone at "make" and "break." The accuracy of the method rests on this. Any oxide or dust at the contact produces "fuzziness" of sound. Oxide is the principal trouble, and as the surfaces p_1 p_2 are respectively a bead and plate of iridio-platinum, this trouble is reduced to a minimum. It is easy to clean the contacts p_1 and p_2.

It is easy to repeat readings to 0·05 μ ($\mu = \frac{1}{1000}$ mm., or micron). The errors found in the Johansson gauges are exceedingly small, being of the order of ¼ micron from point to point of the end surfaces. When the gauge is made up of several smaller gauges "wrung" together, the errors are greater than in the case of a single gauge. In two gauges of English make, the maximum point-to-point errors were 1·2 and 1·45 μ; the gauges agreed at their centres to 0·15 μ.

The machine has been set up at the National Physical Laboratory, and allows comparative readings to be made to within 0·1 μ. The actual length of a solid as compared with a line-standard can also be obtained.

* See E. H. Rayner, "The Shape of Scales Required for Reflecting Instruments with Concave Mirrors," ELECTRICAL REVIEW, July 19th, 1912.

CROSSLEY GAS ENGINES AND PRODUCERS.

AT the Royal Agricultural Society's Show held at Bristol this month, Messrs. Crossley Brothers, Ltd., had a large exhibit of their new type of engine, and one of their new suction gas producers. We illustrate one of the former, rated at 70 H.P.; similar patterns are made up to 300 B.H.P. The bed-plate in this type is supported throughout its length on the concrete foundation, and is cast with an oil groove round the base; the cylinder is supported, not overhung, and all the valves are arranged vertically, the admission valve forming the cover for the exhaust valve, so that there are no unwatered valve covers (fig. 3). There are no bolts or studs in the water-jacket space. A blow-off valve is provided for cleaning the compression space of oil or other deposit while the engine is running, without removing the piston. The governing gear is very simple and sensitive, and graduates the charges according to the load. Ignition is by low-tension magneto. The gas valve is of the screw-down type, with an index plate to register the amount of opening. The cylinder, piston pin, crank pin and exhaust valve are provided with forced lubrication through sight glasses, and the crankshaft and sideshaft bearings have ring lubrication, while the gear wheels all run in oil baths. Small oil engines of extreme simplicity were also shown.

The Crossley patent open-hearth suction gas plant is designed on quite novel lines. The name "Open Hearth" is given to this plant because the fire is at all times in full view of the operator. The generator A, fig. 2, lined with firebrick, is supported by legs B which also carry the circular plates forming the stepped grate. These plates, of which the patent stepped grate consists, are so disposed as to lie outside the angle of repose of the fuel. This ensures that none of the fuel will of itself fall from the grate. Below the bottom stepped grate the fuel rests on its own bed of ashes. The section of the stepped grate plates is also made suitable for the efficient distribution of water, which is obtained from a small pipe D running round the generator case. This water passes in a minute stream into the funnels E, and thence to the grate plates, overflowing from the upper to the lower. By this means the grate is prevented from being burnt out and steam is generated for gas making.

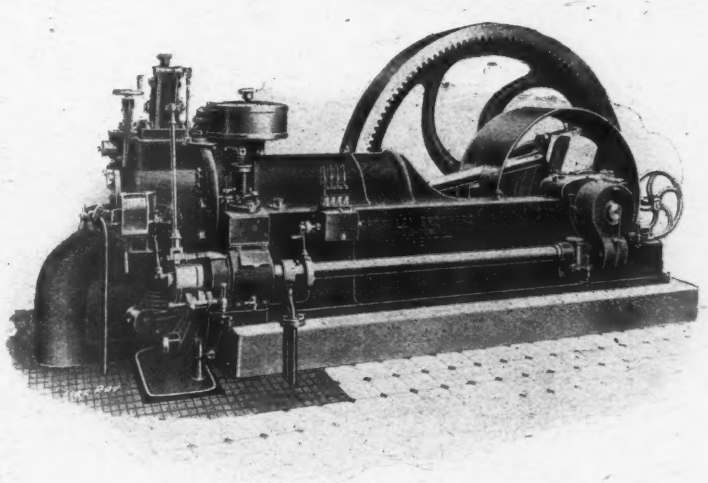


FIG. 1.—CROSSLEY GAS ENGINE, NEW TYPE.

Since there are no vaporisers at the top of the generator, there is nothing to prevent poker holes F being placed adjacent to and parallel with the brick lining. The important feature of this is that when the operator is dealing with badly clinkering fuel, he is able to pass his poker through the generator and free the brick-lining from clinker without damaging the brickwork, as happens in producers where the poke holes are put at an angle from the fuel container. When loosened, the clinker falls, and the operator is then able to see (without opening any doors or otherwise interfering with the quality of the gas) the ash and clinker on the circular plates, whence it may be removed by means of an ordinary rake. If large lumps of clinker have accumulated, they are pushed towards the centre of the grate, and by drawing the ash away from below the centre of the bottom plate, the lumps are easily removed. This type of grate admits of every section of the fire being separately cleaned with ease, and without admitting excess of air. A comparison of this with the ordinary flat grate will at once show its great advantage.

From the generator the gas passes to the external vaporiser G, which forms the communication between the generator and the scrubber. This consists of an outer case, upon the top of which is bolted the box H carrying the gilled tubes J, which have a large

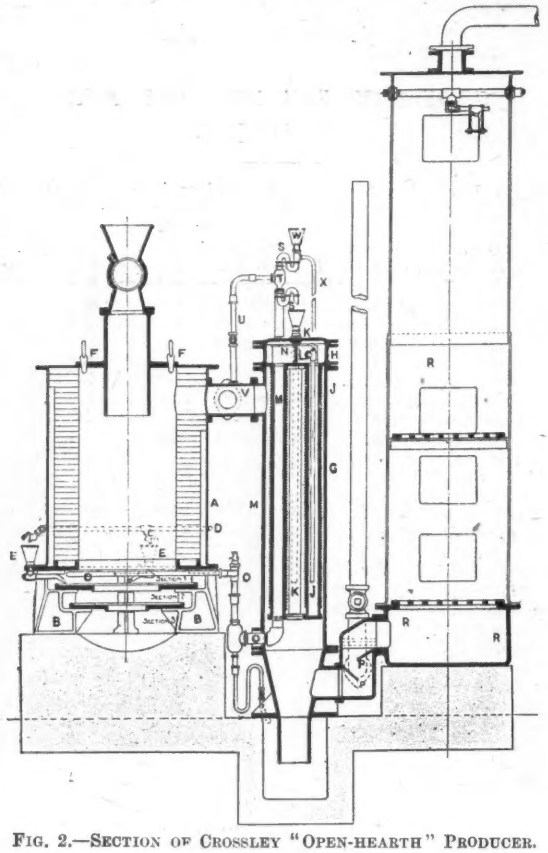


FIG. 2.—SECTION OF CROSSLEY "OPEN-HEARTH" PRODUCER.

heating surface, and convey the heat extracted from the gas to the water for vaporisation purposes. The water for the vaporiser is passed first through an automatic water regulator, and flows down the tube K. This tube is open at the bottom, and the water rises in the gilled tube to the overflow L, to which the feed tube of the next gilled tube in series is connected, and so on through the whole of the gilled tubes except the last. This tube M forms the communication between the steam space N of the vaporiser and the steam distribution pipe O to the producer. The water overflow also from the adjacent gilled tube passes down this pipe M, and is flashed into steam.

The distribution pipe O passes round the fire in the producer, and distributes the steam through a number of spaced holes. With this design of vaporiser, the gas which has to be cooled is external to the water which has to be heated, so that the water is continually surrounded by a jacket of hot gas.

Before passing to the scrubber, the gas passes through two cascades of water P formed by the overflow water from the scrubber. The impact of the water on the gas rids it of the heavier impurities, and thus relieves the coke in the coke scrubber, so that it is not necessary to clean and renew the coke as often as with other arrangements.

The scrubber R R contains two trays for supporting the coke, and filling and emptying doors are so arranged that the coke in the bottom portion of the scrubber (which is the first to foul) can be renewed without interfering with the coke in the upper portion of the scrubber. From the scrubber the gas passes to a combined drier and expansion box. Instead of blowing up with a pressure fan, an exhaust fan is used close to the engine, which draws the air and vapour through the fire exactly like the engine.

The automatic water supply to the vaporiser consists of two tubes S coupled to a small vacuum chamber T, which is connected by the pipe U to the gas outlet pipe V from the generator. Water is fed from a tap into the funnel W, and when the engine is not taking a charge of gas, this water overflows at the pipe X, and runs to the seal box. When the engine takes a charge of gas, however, a vacuum is created in the vacuum chamber T, and water is sucked over the upper tubes and runs into the lower funnel, and thus to the vaporiser. The makers claim that this automatic water supply is the simplest as well as the most efficient apparatus extant for its purpose. There are no moving parts whatever with the exception of the water. The supply of water to the vaporiser is, therefore, automatically regulated to suit the load on the engine, thus giving a constant supply of gas of good regular quality.

All parts of the producer which are subject to excessive corrosion are of cast-iron.

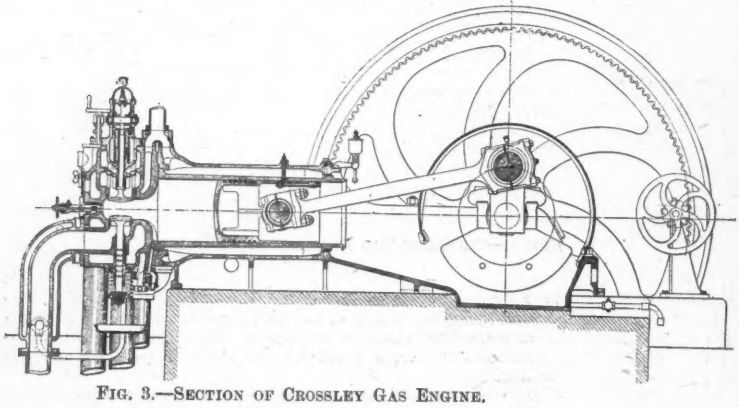


FIG. 3.—SECTION OF CROSSLEY GAS ENGINE.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Adams Igranic" Arc-Preventing Interlock.

While the arc-preventing interlock device employed by the ADAMS MANUFACTURING CO., LTD., of Balfour House, Finsbury Pavement, E.C., is not new, having been fitted to several types of their motor control panels during recent years, its mode of operation appears to be unfamiliar to electrical engineers; we recently inspected a starter fitted with the device, which is extremely simple and ingenious. In the accompanying illustration showing the firm's "Inching" starter as used by printers—a class of starter in which the interlock is particularly necessary owing to the very frequent starts and stops when inching the press—the interlock is seen at X just below the starting arm, which is actuated by a handle passing through the lid of the box. It consists of a small metal roller running on a brass segment, and completing the circuit through a solenoid which closes the circuit-breaker, which is in the main circuit. The segment above mentioned is divided, with a resistance between the two parts, so that while the first contact passes a strong current to operate the circuit-breaker, the subsequent motion of the roller on to the second portion of the segment cuts down the current to a value sufficient only to hold the circuit-breaker in, but not to close it.

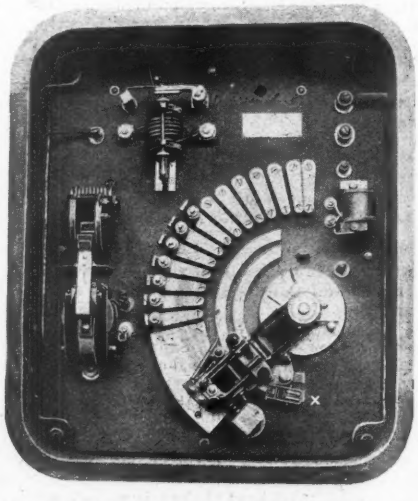


FIG. 1.—"ADAMS IGRANIC" INCHING STARTER (WITH DOOR REMOVED).

The roller, however, does not actually roll, but slides on the segments; and it is provided with two cam-shaped cheeks of insulating material, which provide the essential feature of the device—the arc-preventing interlock. If at *any* portion of its travel the handle is moved back a short distance, the roller turns and the cam-shaped cheeks come into play, lifting the roller out of contact with the segment and thus opening the solenoid circuit, so that the breaker instantly opens. The current broken by the roller being reduced, as mentioned above, causes no sparking worth mentioning, and the main circuit is always made and broken by the circuit-breaker, which has a magnetic blow-out, renewable contact-pieces and carbon tips.

Again, owing to the reduced current, the main circuit cannot be closed again without returning the handle to the "off" position, and thereby reinserting all the starting resistance. The circuit-breaker is provided with an automatic overload release, which is operative at all times, whether the motor is starting or has run up to speed; should the operator start up too quickly, also, the breaker opens. Returning the handle to the "off" position resets the overload release.

While it is not easy to describe the interlock in words, its action is extremely simple and certain, and ensures that all the hard work shall be done by the circuit-breaker, so that the starting switch contacts are completely preserved from burning. The device is fitted to the Adams Igranic "Conspede" and "Varispede" panels, which we have previously illustrated; the latter is provided with a shunt regulating handle in addition to the starting handle, and both panels have double-pole circuit-breakers, so that main switches and fuses are unnecessary. It is impossible to make a mistake when starting a motor with any of these panels, as there is only one starting handle, and any wrong use of it results in cutting off the current.

The "Pelapone" Oil Engine.

A paraffin engine of the vertical four-cycle type, called the "Pelapone" engine, has been introduced by the ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109-111, New Oxford Street, W.C., and is illustrated herewith, the figure showing the standard four-cylinder electric lighting set. High speed is one of the leading features of the type, which runs at 800-850 R.P.M., and can be started up from the cold by hand without the use of a blow-lamp. Large bearing surface is provided, and the moving parts are

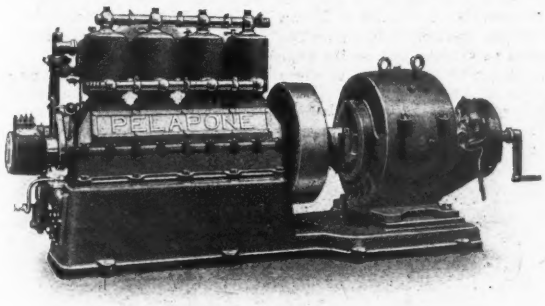


FIG. 2.—"PELAPONE" 12-H.P. ELECTRIC LIGHTING SET.

well balanced. The materials used are of high quality, and forced lubrication is provided.

The vaporiser is designed on a new principle, which enables a fixed gas to be produced, resulting in perfect combustion and clean cylinders and exhaust; both quantity and quality of mixture are automatically adjusted to suit the load, and the speed is controlled by a sensitive shaft governor. An explosion takes place on every firing stroke.

Meter Boards.

The accompanying illustration shows a meter board which has been adopted as standard by an electrical supply company in Burmah. As will be seen, the fuses are of the Zed type throughout. This type has been chosen because the company find them to be particularly suitable for meeting the various difficulties which occur

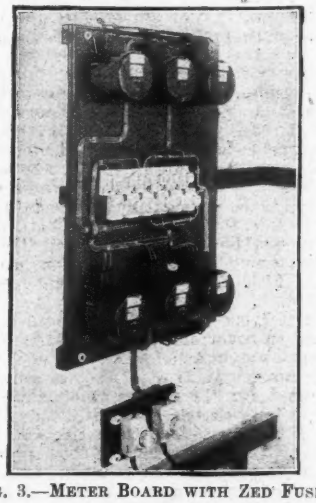


FIG. 3.—METER BOARD WITH ZED FUSES.

where native labour is employed. With the Zed type of fuse, it is an easy matter for a native to replace a blown fuse correctly, without any risk of over-fusing or receiving a shock. The board illustrated represents a type which is in use in large office buildings where a number of suites of offices on one floor have separate meters.

It is difficult for anyone not intimately acquainted with natives to realise to what heights of absurdity they can ascend when connecting up or attending to electrical apparatus, and from this point of view, Zed fuses have been found eminently satisfactory. Many of the large electricity supply companies which have tried the "Z" fuses have been led to adopt them exclusively, owing to their reliability and the control thus obtained over the operations of men sent out to replace blown fuses.

A New Vacuum Gauge.

Mr. Irving Langmuir recently described before the American Physical Society a new vacuum gauge of great sensitiveness.

At very low pressures the viscosity of gases is one of their most marked characteristics. This property is made use of in the new gauge, which consists of a rotating disk above which is suspended, by a quartz fibre, another disk carrying a mirror. The viscosity of the gas causes it to be set in motion by the lower disk, and this motion produces a torque on the upper disk which can be measured in the usual way by a beam of light reflected from the mirror.

The rotating disk is made of thin aluminium, and is attached to a steel or tungsten shaft mounted on jewel bearings and carrying a magnetic needle. The suspended disk is of very thin mica. The lower disk can be rotated easily at a speed of 10,000 R.P.M. by means of a rotating magnetic field produced outside the bulb containing the two disks.

The sensitiveness of the gauge is extremely high. At 1,000 R.P.M., with a scale at about 60 cm. distance, about 400 mm. deflection is obtained for ·001 mm. of air. The deflection is exactly proportional to the pressure below about ·01 mm., proportional to the speed of the revolving disk and practically independent of the distance between the two disks. For different gases at the same pressure the deflections are proportional to the square root of the molecular weights. All these facts are in accord with the kinetic theory. At 10,000 R.P.M., 1 mm. deflection corresponds to ·00000025 mm. There should therefore be no difficulty in detecting pressures as low as 10^{-7} mm.

LEGAL.

L.C.C. TRAMCAR ACCIDENT CLAIMS.

THE turning over of one of the London County Council's electric tramcars at New Cross on the afternoon of September 2nd, 1911, was the subject of an action for compensation for personal injury, heard in the King's Bench Division on July 16th, before Mr. Justice Bray and a special jury. The plaintiff was Mr. Percy Mead Brambleby, a clerk, and he sued on behalf of his three children, aged 7, 5 and 4 years, and he alleged negligence against the driver of one of the Council's cars. Mrs. Brambleby also claimed damages for injuries sustained on the same occasion.

The Council admitted negligence, so that the only question to be determined was that of damages. It was alleged that the cause of the accident was the too rapid pace at which the driver came down the incline to a junction, coupled with the worn state of the rails at the point.

Medical evidence having been given concerning the nature of the injuries, the jury assessed the damages as follows:—Mr. Brambleby, £40 on account of expenses; Mrs. Brambleby, £190; the boy Ernest, £100; the boy John, £600; and the little girl, £30. His Lordship entered judgment for Mrs. Brambleby, the boy John and the girl for the amounts awarded, with costs. In the case of Mr. Brambleby and the boy Ernest, judgment was entered for the County Council, they having paid into Court sums larger than those which the jury awarded.

THE NATIONAL TELEPHONE CO.—DISTRIBUTION OF ASSETS.

(*Concluded from page* 96.)

THE matter having been argued before his Lordship by counsel representing the different classes of holders, his LORDSHIP proceeded to deliver his judgment, giving the whole of the fund to the deferred stockholders. The matter, he said, was one of some complication, but it had been argued before him most carefully and fully, and he did not think that he would better matters by reserving his judgment, especially as he felt very confident that the case would be carried higher, whatever his decision might be. The matter seemed to be governed by Sec. 86 of the Act of Parliament, which provided that unless the articles contained anything to the contrary, any surplus should be distributed amongst the members according to their rights and interests in the company. The effect of that was that the distribution in the first instance was regulated by the provisions in the articles. The first question he had to determine, therefore, was whether on the true construction of the articles there were other provisions which dealt with the distribution of this surplus. If there were such other provisions a number of cases cited were excluded from consideration because they only dealt with the way in which the assets should be divided amongst the members according to their rights and interests, there being no other provision in the articles. If the articles did, in fact, provide that the surplus assets should be divided in some particular way, that particular manner must have precedence over general equity or right. Here there were no less than five sets of claimants—the first second,

and third debenture-holders, and the preferred and deferred ordinary stockholders. This surplus of £200,000 which had to be dealt with was a surplus that might be looked upon as the remains of a very large reserve fund, which was from time to time set aside, and had certainly not been appropriated to capital. He thought nothing was ever done by the company which definitely turned the reserve fund into capital and prevented it being distributed as dividend if the company had been so minded. The rights of the first preference shareholders depended upon Article 33 of the original articles, and under that he came to the conclusion that they were not entitled to more than repayment of their capital, with the interest stipulated for. The second preference were on a somewhat different footing, as they had a share in the profits beyond the fixed per cent. rate that their shares were to bear, but upon the construction of the articles it seemed to him that that was limited to the annual profits made by the company, and there was nothing to show that they were entitled to any return of capital beyond the nominal amount of their shares. It seemed to him that the conclusion any business man would come to was that the second preference were not entitled to more than the return of their capital. With regard to the third preference, their right to be repaid preferentially entirely negatived any right of the holders of those shares to participate to any further extent in a winding up. There was nothing, in his opinion, in the articles that compelled him to come to a different conclusion from that which he had mentioned, that any share that had preference over the ordinary shares was not entitled to anything beyond the amount of the preference dividend. In all the cases to the contrary it had been expressly provided that the rights in the event of a winding up were to be analogous to the rights existing while the company was going on. The fact that the preference shares had express rights attaching to them in the event of a winding up negatived the contention that they were entitled to any further rights in this surplus, and he must hold that the first, second and third preference shareholders took no share in this excess of assets. For the same reasons he must hold that the preferred ordinary were not entitled to anything more than the nominal amount of their shares with the 5 per cent. bonus that had already been paid. The whole surplus, therefore, he held was divisible amongst the deferred shareholders, and the others were not entitled to anything beyond that from December, 1911.

Mr. Danckwerts said that the costs of all parties as between solicitor and client would be paid out of the surplus fund, but he must warn the parties that in the event of an appeal the liquidator would not pay the costs.

Mr. Lawrence said that would be as the Court of Appeal would order.

An order for distribution of the fund was made in accordance with his Lordship's judgment, but its operation was stayed pending an appeal.

Prested Miners' Gas Indicating Electric Lamp Co., Ltd.

In the Companies' Winding-Up Court on Tuesday, Mr. Justice Neville had a petition before him by George Reynolds, Ltd., for the compulsory winding up of this company.

It was stated that it was a judgment creditor's petition for the winding up of the company; there was no opposition. The company was formed in 1903, with a nominal capital of £25,000. The petitioner supplied goods to the amount of £51 in August, 1911, and in October of the same year a Receiver was put in on behalf of the debenture stockholders. The petitioner issued a writ on February 3rd, and judgment was entered in default of appearance.

His Lordship made the usual order.

Hendon Urban Council and the Telephone Service.

In the Railway and Canal Commission Court, on July 17th, Mr. Justice Bankes presiding, an important decision was given in the matter of the application under the Telegraph Acts 1863 to 1911, asking the Court to determine a dispute between H.M.'s Postmaster-General and the Urban District Council of Hendon in regard to the placing of telephone lines along certain roads in the Council's area. In July, 1912, the Postmaster-General, by notice in writing, asked the consent of the Hendon authority to lay the lines along three roads in the district, and the Council declared their inability to give the necessary consent, on the grounds that the roads were not highways, and so not streets or roads within the meaning of the Telegraph Acts, therefore the Council had no concern with them. Further, they contended that if the roads were streets or roads within the meaning of the Acts, they were not repairable at the public expense, and the Council were not the body having control of them within the meaning of the Acts. In accordance with Sec. 7 of the Telegraph Act of 1874, the matter came before the County Court Judge, who gave his decision in favour of the Council. The Postmaster-General, dissatisfied with the award, then brought the matter to the Railway and Canal Commission Court for determination, as he was entitled to do under the provisions of the Acts.

In delivering judgment, Mr. Justice Bankes said the only point the Court had to decide was whether the roads in question were under the control of the District Council, and in determining that point it was necessary to examine the statutes very closely in order to see whether the present case differed from the case which governed the matter, viz., the Redhill Gas Co. and the Reigate Rural District Council. In that case the question turned on whether the Reigate U.D.C. were persons having the control or management of a certain road within the meaning of the Gas Works Clauses Act, 1874. In his Lordship's opinion no distinction could be drawn between that case and the one before him. The two judges who constituted the Court in the Reigate case dealt with a point which was fatal to the contention of the Postmaster-General in the present case. The Lord Chief Justice expressly held that where a road was made up under the powers of the Public Health Act, 1875, and the Private Streets Works Act, 1892, it did not come under the control of the local authority until the work was completed and the road had been taken over. He (Mr. Justice Bankes) was bound by the decision in the Reigate case, and accordingly the Court must determine the difference adversely to the contention of the Postmaster-General.

Sir James Woodhouse concurred, and Mr. Justice Bankes said he had the authority of his other colleague, Mr. Gathorne Hardy, who was not present, to say that he also agreed with his Lordship's judgment.

Baxter & Caunter, Ltd., *v.* Levetus.

The above action was mentioned to Mr. Justice Darling in the King's Bench Division, on Monday, July 21st. The action, it was stated, was for an injunction against the defendant to restrain him from dealing with certain electrical appliances.

Mr. Whateley, who appeared for the plaintiffs, said his clients went before Mr. Justice Channell, and were granted an interlocutory injunction. The Judge also ordered that there should be a speedy trial of the action. He therefore asked that a day should be fixed for the trial.

Mr. Cox-Sinclair (for the defendant) said he opposed the application, and argued that the plaintiffs' claim showed nothing which warranted the granting of an injunction, while there was not an atom of reason for expediting the hearing.

Mr. Whateley said the plaintiffs were dealers in electric appliances, and their complaint was that the defendant approached them and bought goods from them pretending that they were for foreign export. By that means they were obtained cheaper. Then, under another name, it was alleged defendant sold the goods to the trade, with the result that the plaintiffs' trade was greatly affected.

The Judge—Are they doing it now?

Counsel—No, because they were found out, and we presumed they stopped it.

His Lordship said in that case there was no need for an injunction. Having regard to the paucity of Judges and the number of cases awaiting trial before the one in question, he could not fix a day for its hearing.

Mygatt *v.* Glyn.

In the King's Bench Division on July 17th, the hearing was commenced of an action brought by Mr. Otis Angelo Mygatt, of Clifford Street, Bond Street, W., against Major Geoffrey Carr Glyn, of Eaton Place, W., and Sharnbrook, Beds. The action arose out of a transaction between the parties consequent to the formation of Holophane, Ltd., a company registered in England in July, 1911.

Mr. Mygatt claimed to recover £4,254 on a bill of exchange dated April, 1911, drawn by the plaintiff and accepted by the defendant and payable on demand and to the order of the plaintiff, and which, plaintiff said, on being duly endorsed and presented by him was dishonoured. It was stated that the defendant and plaintiff were associated in the promotion of Holophane, Ltd. In his defence, and in support of his counterclaim, Major Glyn said that in consideration of his agreement to act as managing director of the company in question for a period of five years from the date of his appointment, and assisting in the building up of the business in England and Europe, it was agreed that the plaintiff should transfer to him certain preference and ordinary shares in the company on the terms that the said shares should become the defendant's property if he continued to act as managing director for the term specified. Meanwhile, the defendant said, he was to hand to the plaintiff a bill of exchange, the condition being that it should not be made payable in the event of his so acting. He continued to act as the managing director of Holophane, Ltd., down to April, 1912, and he, therefore, denied that he was liable on the bill. Defendant counterclaimed for 10 per cent. commission on the stock transferred to the plaintiff as vendor, and 10 per cent. of the plaintiff's profits from the company, which, he said, it was agreed to allow him in consideration of his relieving the plaintiff of the routine business connected with the company, and which he had not been paid. Plaintiff's reply to the counterclaim was a denial of the agreement.

Mr. McCall, K.C., opened the defendant's case first, and said that Major Glyn had an honourable business and military record behind him. Mr. Mygatt was an American citizen, and had a considerable interest in a company registered in America called the Holophane Glass Co., formed for the purpose of obtaining the maximum amount of light from electric globes by the use of a patent called Holophane. Mr. Mygatt wanted the assistance of a gentleman with a reputation for business and good character, who would form an English company or otherwise secure an amalgamation of the English and American concerns. Major Glyn accepted the post, and he was promised a salary of £600 a year payable by the plaintiff until the company was formed and by the company afterwards. Major Glyn set to work. He used his influence and secured capital from his friends, and the company was promoted. He went to America and settled up difficulties there and received a promise of

substantial compensation for his trouble from the plaintiff. He also secured a contract while in America with the General Electric Co., by which that company agreed to take over the business of the Holophane Glass Co. and pay the Holophane Co. a considerable amount of money. Plaintiff promised the defendant 10 per cent. of the shares he should receive from the new English company as vendor, and 10 per cent. of his profits from the company on the understanding that the defendant should relieve him of all routine work. Major Glyn, in return, gave the bill on which the plaintiff now sued, on the understanding that it should not be made payable if he occupied the position of managing director of the company for five years. When the company was formed Major Glyn was appointed managing director. Shortly afterwards friction arose between the company and Mr. Mygatt over the assets of the old business, the company demanding that Mr. Mygatt should hand over to them certain shares and property which, they alleged, he held. Mr. Mygatt refused, on the ground that he owed the company nothing. Following that, for some reason or other, Mr. Mygatt decided to get rid of Major Glyn, and at a board meeting a resolution was passed, in April, 1912, which amounted to a dismissal of the defendant from his position. Allegations were made against the defendant that he had perpetrated a fraud on the trade by selling a shade called Dilux as Holophane, and, said counsel, an action had recently been heard, which was brought by Major Glyn, in which that gentleman was awarded damages against the company for wrongful dismissal. That, contended counsel, amounted to a decision by the jury that the plaintiff had no right to deprive the defendant of his office, and could not, therefore, demand payment on the bill in this action.

On Friday, July 18th, when the hearing of the case was further continued, MR. MCCALL, K.C., said that the bill was presented on October 29th, 1912, and dishonoured, and on November 5th the writ was issued. During the proceedings on this day the services of the jury were dispensed with by consent.

MAJOR GLYN gave evidence, and on Monday he continued to do so.

On Tuesday the hearing was further continued before Mr. Justice Bankes, and after additional formal evidence, the case for the defendant concluded.

MR. GORE BROWNE, K.C., then opened the plaintiffs' case, and ultimately called MR. MYGATT, who, in the course of his evidence, said that he had been connected with the working of the Holophane patents for 20 years, and did all the work in America, legal and otherwise. He spent about $100,000 when the American company was formed. Having detailed the arrangements for the formation of a company to work the European business and traced the history of the project to promote the English company, witness spoke to the arrangements made with Major Glyn, and said:—In regard to the two separate commissions of 10 per cent. claimed by Major Glyn in this action, he told the defendant that he could not make any definite arrangement. From November 5th, down to the time that the counterclaim was put in, Major Glyn never claimed that he was entitled to the 10 per cent. on his (Mr. Mygatt) profits, as distinguished from the shares. As to the services rendered for him by the defendant, those rendered prior to the formation of the company were those of a friend, and he in no way represented witness's interests, either in England or America. As far as England was concerned, the defendant largely took the commercial and routine business into his hands. In regard to signing the shares transfer, so far as he could recollect he said he would sign it if his solicitor so advised, but he had never consciously agreed to sign the transfer to Major Glyn.

Cross-examined, MR. MYGATT said he paid the defendant £600 a year for his services in relieving witness of the routine work, &c., pending the formation of the new company, and the 10 per cent. agreement did not apply till the company was formed. He was to have 10 per cent. upon the income of witness if the flotation was successful, and if he (Major Glynn) got £40,000. The 10 per cent. was to date from the time that the syndicate was formed. He was to work up to the time that the syndicate was formed without receiving any commission on his (witness's) income.

Ultimately the evidence concluded, and counsel on both sides proceeded to address the Judge.

Eventually MR. JUSTICE BANKES reserved judgment.

COLLIERY MANAGER SUMMONED.

ON Saturday last at Chesterfield Mr. Thomas Henry Elliott, manager of the Langwith Colliery, belonging to the Sheepbridge Coal and Iron Co., was summoned on three counts for breaches of electricity special rules, viz. (1) a metallic covering of a lampholder not being earthed; (2) not protecting live parts (switch and fuse); and (3) not having a metallic switch-box earthed. The facts were not contested.

According to the report of the hearing in the *Yorkshire Daily Observer*, MR. GICHARD, appearing on instructions from the Public Prosecutor, said that on March 5th an accident at the Langwith Colliery resulted in the death of a youth. Shortly before the youth fell to the ground he was near a prop used for supporting the roof. To that prop was affixed an electric lamp, and immediately after the boy's death it was noticed that the lamp was hanging down, the inference being that the lad had touched the lamp and received a fatal shock. His Majesty's inspector discovered that the lamp had not been earthed by means of a wire. An inspection of other parts of the mine disclosed two other breaches of the regulations. Had the lamp been earthed the lad would not have met his death. It might be argued that the manager was not responsible, as there was a qualified electrician, but he (Mr. Gichard) would be able to prove that by law the certificated manager was the person responsible for the apparatus, &c.

MR. ROBERT NELSON, Home Office Electrical Inspector of Mines, spoke as to the lamp in question not being earthed. He also pointed out the dangerous nature of the unprotected live parts. He was aware that the company had adopted a new system of earthing, and that the cable put in passed within a few inches of the lamp.

The defence was that the manager had taken every reasonable means by the appointment of qualified electricians to prevent contravention of the electrical rules.

The Bench imposed a fine of £1 and £5 5s. as costs in regard to the "non-earthed lamp" and dismissed the other two cases.

ALDRIDGE *v.* HOBART ELECTRIC MANUFACTURING CO.

AT the Gateshead-on-Tyne County Court on the 15th inst., an action for the recovery of £11 7s. for work done and materials supplied was brought by Henry William Aldridge, electrical engineer, of Coronation Buildings, High Street, Gateshead, against the Hobart Electric Manufacturing Co., of Charterhouse Street, London. Mr. R. S. Holmes was for the plaintiff, and Mr. J. J. McIntyre was for the defendant company. According to the evidence for the plaintiff, it appeared that the defendant company, desiring to hold a demonstration of electrically-driven mincing machines before Gateshead butchers, and being unable to get a suitable shop, had made use of plaintiff's premises. A man named Beck, who gave out that he was acting for the defendants, had charge of the arrangements for installing the machines. Mr. McIntyre said that Beck was no longer in the defendants' service. On the ground that it was a private debt incurred by their agent, the defendants denied their liability to pay the account. Plaintiff, cross-examined, said it was not until he had lost sight of Beck that he applied to the defendants, asking them to pay for the installation. Mr. McIntyre submitted that there was no case for him to answer. The defendants denied that Beck was anything but a sales agent for them. He was not their representative. Plaintiff, re-called, said Beck opened a business office in Grainger Street, Newcastle-on-Tyne, with the company's name on the door.—Mr. McIntyre: What exactly was on the door?—Plaintiff: "Hobart."—Mr. McIntyre: But not the full title of the company. It was not their branch office at all.—His Honour gave judgment for the defendants with costs.

BUSINESS NOTES.

American Lamp Sales.—A report by the Lamp Committee of the NATIONAL ELECTRIC LIGHT ASSOCIATION, of America, shows that the total sales of glow lamps for domestic use in 1912 aggregated about 90 millions, of which carbon lamps represented 25·47 per cent. (a drop from 52·9 in 1911), Gem lamps 33·59 per cent. (19 in 1911), tantalum 1 per cent. (2·74 in 1911), and Mazda lamps 39·94 per cent. (25·3 in 1911). This year it is expected that carbon lamps sales will be less than 10 per cent. of the total. It is noteworthy that the sales of Gem (metallised filament) lamps are increasing steadily at the same rate as of Mazda lamps.

The Balkan War and Austria's Electrical Trade.—On the position of the electrical industry in Austria during the past year, the *Neue Freie Presse* makes the following observations:—Up to the outbreak of the Balkan war, Austria's trade in general, and that of the electrical industry in particular, was marked by a noteworthy expansion. The sales of high-pressure machines, both constant and rotary-current generators and motors, as well as of transformers, were heavier, in connection with the more active tendency shown in the construction of light and power installations, bulk supply stations, and electric tramways. The mining and iron industries likewise furnished good business. On the other hand, main line traction demand still maintained a halting attitude, while for abroad calls were numerous. Low-pressure manufactories were also well employed, as, on one hand, the newly-established, or enlarged, telephone systems yielded a considerable number of orders, and, on the other, the enormous world-demand induced a steady expansion of the glow-lamp section. Prices in the high-pressure industry, nevertheless, on account of causes frequently alluded to, did not keep pace with the sales. Sharp competition, unfavourable conditions of production, the high prices of raw materials and important finished articles, with which the high-pressure industry had to contend, have continued, and even show signs of increasing. On this account, an active development of the profit-earning capacity of the high-pressure industry is not to be too hastily forecasted, although the situation for light and power suppliers and the low-pressure branch may be more favourably judged. The Balkan war has adversely influenced every branch of the electrical industry. Consumers in the country districts withheld orders and investment, while the dearness of money prevailed, and the political uncertainties paralysed every kind of business operation. Austria supplies the greater part of the electrical requirements of the Balkan lands, and political interruption of business was naturally productive of the greatest prejudice. By the geographical position of the Monarchy, and the fact that the Austrian electrical industry in all its branches stands on a level equal with that of foreign countries, foreign competition in most of the Balkan States during the year was successfully opposed;

nevertheless, the prices of raw material, high wages, heavy tax burdens, unfortunate commercial treaties, and many other oft-cited drawbacks, hindered a sound export trade. The immediate prospects of the electrical industry depend upon whether the political uncertainties will be shortly terminated. A powerful economic improvement would give the electrical industries a desirable stimulus, which would be enhanced by a more active giving out of State orders.

Book Notices.—*Car Troubles.* By H. W. Slanson, M.E. London: Harper & Bros. Price 1s. net.—This little book is printed on stout paper, obviously to stand hard wear; the contents relate to the symptoms of the various motor troubles, and set forth the remedies to be applied in the briefest possible manner. Care has been taken to organise the matter so as to facilitate reference in emergency, and the book will no doubt be found a valuable aid by motorists.

We recently received copies of the *Transactions* of the New York Electrical Society, of which five issues have now appeared. The printing of the *Transactions* is a new departure, marking an important stage in the development of the Society, which was founded in 1881 to present in popular form the latest advances in the electrical and allied sciences. Mr. H. H. Barnes, jun., is president, and Mr. George H. Guy (29, West 39th Street), secretary. Some excellent papers are printed in the *Transactions*.

The Syndics of the *Cambridge University Press* announce that they have undertaken the publication of a new and important series of books on technical subjects. The first list of books in preparation includes "Electro-Technical Measurements," by A. E. Moore; "Alternating Currents," by W. H. N. James; and "Electrical Engineering," by T. C. Baillie.

"Switches and Switchgear." By Prof. R. Elder and Ph. Laubach. Price 15s. net. "High and Low-Tension Switchgear Design." By A. G. Collis. Price 10s. 6d. net. 1913. London: Constable & Co., Ltd.

"The Post Office Electrical Engineers' Journal." Vol. VI, Part 2. July, 1913. London: H. Alabaster, Gatehouse & Co. Price 2s. net.

"Regulations for Technical Schools, Schools of Art, and other Forms of Provision of Further Education in England and Wales." 1913. London: Wyman & Sons, Ltd. Price 2d.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 2. April-June, 1913. London: John Murray. Price 2s. 6d. net.

"*Journal* of the Municipal School of Technology, Manchester." Vol. VI. With Prospectus for 1913-14. Manchester: The Education Committee.

"*Transactions* of the Toronto Engineering Society." Vol. VIII, No. 1. May, 1913. Toronto: The University.

"*Proceedings* of the Forty-Sixth Annual Convention," and "Annuary for 1913 of the American Institute of Architects." Washington: The Institute.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 1. July, 1913. Philadelphia: The Institute. Price 50 cents.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 13. July 15th, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

G.E.C. Electrical Novelties.—A pocket flash lamp called the "Defiance" has been placed on the market by the G.E.C. LTD., which resembles an automatic pistol. There is a two-cell battery within the stock of the pistol, and the lamp is an Osram drawn-wire battery lamp fitted in the muzzle. The action of the switch is controlled by the trigger, and a locking pin enables the light to be kept on for several minutes if desired.

Another electrical novelty is a model water turbine, coupled to a magneto generator giving 8-10 volts and about 12 watts. It can be coupled to a main water tap.

Cable Manufacture in Germany.—The copper works of the J. Wahlen Co., of Cologne, have been acquired by the BROWN-BOVERI group at a price of from £25,000 to £37,000, and have been transferred to a special concern bearing the title of the Rhenish Wire and Cable Works Co. Most of the shares in the latter are held by the Swiss Brown-Boveri Co., whilst a further portion is in the possession of the latter's subsidiary company at Mannheim. It is now intended to extend the copper works with special reference to undertaking the manufacture of cables, so that the Swiss-German group in question may render itself independent of the German cable syndicate as far as possible.

Trade Prospects in the Balkan States.—When the war in the East is satisfactorily concluded, the former Turkish vassel States should afford additional outlets for trade in electrical manufactures, for a due share in which preparations should be made in advance. On the methods of securing business, our contemporary, *Elektrotechnik und Maschinenbau*, tenders the following observations:—No manufacturer capable of doing an export business should shun the task, either personally or by means of responsible technically-equipped agents, of collecting the needful information as to local requirements in his branch in the important places of trade in the several countries. This course will most quickly conduce to success. In Bulgaria, in particular, the engagement of a capable technical representative is absolutely needful. A great mistake is made by those exporting firms who engage an agent at Bucharest, and also entrust to him the representation for the country districts, the plan usually involving the disadvantages of extension of credit, postponement of payments, reduction in prices, and reduced purchasing power. An exporting firm having engaged a capable traveller with the recommendation of a local Consul, may scrupulously follow his advice as regards samples, dates of delivery, and conditions of payment. The forwarding of the goods to destinations is matter for consideration, and it is best to follow exactly the instructions given. Where none are given, or merely "by the shortest route," regard must be had to time, as delay on the passage may involve expense exceeding the value of the invoice. In this matter the instructions of the agent should be studiously followed. The character of the package should also be arranged to suit the circumstances. When goods are forwarded by post, the weight and size of the parcel must be considered. The registration of parcels should not be overlooked, and an understanding come to beforehand with the customer as to who shall bear the cost. Laws governing travellers have been in existence some years in Bulgaria, neglect of which involves many difficulties. Foreign agents and travellers, equipped with vouchers from home Chambers of Commerce, are required to take out trade licences at the Custom House at the port of entry, and to make a money payment according to the volume of business, ranging from 50, 100 and 150 fr. per year, besides a stamp tax of 5 fr. These amounts are, however, only exacted from those firms having no resident agent in direct connection with customers. Resident agents are required to keep an order book wherein each order must be entered on the spot when taken, and stamped with a 10-centime stamp. Before entering into trade relations it is also advisable to seek such information regarding local firms as the local Consul may be able to afford, but in this direction English Consuls lend less assistance to the export trade than do foreign Consuls. To this information a German correspondent of the *Berliner Börsen Courier* adds the following:—The great advance now observable in Bulgarian trade owes its origin to the steps taken by the Government in the nineties to foster trade by various politico-fiscal measures and industrial laws. These efforts have not remained fruitless, the more so as valuable vegetable and animal products, mineral wealth, and water-power provide conditions which ensure a prosperous future. Here and there also foreign capital has been invested in the developments of Bulgarian industries. In 1909 the number of industries receiving subsidies from the State totalled 266. In 1911 the number had risen to 293, comprising food and provisions, 103; textile, 67; chemical and related industries, 43; leather, 22; metal, 22; timber and wood, 18; porcelain, 9; paper, 3, &c. In 1911 about 50 new industrial undertakings were started, with an aggregate capital of £1,000,000. Among the new concessions granted were 4 for beet sugar manufacture, 2 for chemical manures, and 2 for cement and hydraulic lime. Electric motive power is coming into use in many of these industries and notably in that of timber which has its chief seat at Rustschuk, where are establishments equipped in the most modern style. The iron and metal industries have also made great strides, but in the opinion of this German correspondent Bulgaria will remain for many long years dependent on oversea manufactories for iron and metal goods and machinery. The textile industries are also developing rapidly, aided by the abundant native supplies of wool.

A Hospital Carnival.—On Saturday, July 12th, at the annual Ilford Hospital Carnival, in the section for best decorated trade vans, THE GENERAL ELECTRIC CO., LTD., secured a first-class certificate for an elaborately decorated Osram motor van. The scheme for the decoration included a tableau of "Aladdin and the Wonderful Osram Lamp." The artistic effect was enhanced by a careful arrangement around the vehicle of Osram battery and automobile lamps, current for which was supplied from portable accumulators within the van. Naturally, the illumination showed up to best advantage in the evening. A powerful "Rushmore" searchlight was fitted to the canopy over the driver's seat.

The decorated Osram motor van also secured the first prize for decorated vehicles at Willesden on Thursday last week. Later, the Rushmore searchlight, which is part of the equipment, provided the necessary illumination for both band and dancers.

Auction Sale.—Particulars will be found in our advertisement pages of an auction sale of electrical apparatus to be conducted by MESSRS. PERCY HUDDLESTON & CO., at Hammersmith, on Tuesday next, July 29th.

The Holidays.—The works of the LONDON ELECTRIC FIRM, George Street, Croydon, will be closed from Saturday, August 2nd, to Monday, August 11th, for the annual holidays.

THE LANGDON-DAVIES MOTOR CO. announce that their works will be closed during August Bank Holiday week.

The works of the BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., at Trafford Park, will be closed from this evening (Friday, July 25th) until the morning of Tuesday, August 5th, for the annual holidays.

The works of MESSRS. T. W. BROADBENT, LTD., Huddersfield, will be closed from Friday, July 25th, to Tuesday, August 5th, for the annual holidays.

THE RECORD ELECTRICAL CO., LTD., notify that their works at Broadheath, Altrincham, will be closed from Friday, August 1st, until Monday, August 11th, for the annual holidays.

The offices and works of the BRITISH PROMETHEUS CO., LTD., will be closed from July 31st to the morning of Monday, August 11th, for the holidays.

The works of the WALSALL ELECTRICAL CO., LTD., will be closed from July 31st to August 11th for stock-taking and the annual holidays.

MESSRS. CRYSELCO, LTD., of Kempston Works, Bedford, announce that their works will be closed from Saturday August 2nd, until Monday, August 11th.

The works of MESSRS. HIGGS BROS., of Balsall Heath, Birmingham, will be closed from Friday evening, August 1st, until the morning of August 10th.

In all the above cases a small staff will, as usual, be in attendance to attend to urgent matters.

Catalogues and Lists.—THE D.P. BATTERY CO., LTD., Lumford Mills, Bakewell, Derbyshire.—Catalogue (26 sheets) containing illustrations and tabulated particulars respecting capacities, dimensions, weights, prices, &c., of various types of D. P. batteries —FX, TX, LX, LSX, F, T, L, and LS—for central station, country house, yacht, traction, telegraph, and telephone and portable service. Lists of important users, dimensioned diagrams of plates and drawings of stands, also details of renewals, accessories, &c., are given.

MESSRS. D. H. BONNELLA & SON, LTD., 58 and 60, Mortimer Street, London, W.—48-page catalogue (new edition), of motor-car electrical installation accessories, illustrations, descriptive notes, and prices being given of a large variety of roof lights, steering column and dashboard lamps, switches for interior lighting, motor telephones, accumulators, measuring instruments, Osram lamps, side, head, step and hand lamps, as well as various general carriage fittings and equipments, tool kits, &c.

MESSRS. A. REYROLLE & CO., LTD., Hebburn on-Tyne.—Illustrated list, No. 60, describing and stating prices and dimensions of single and three-phase potential transformers; also list, No. 48, relating to, and illustrating and pricing, their watertight wall plugs and sockets.

MESSRS. BRUCE PEEBLES & CO, LTD., Edinburgh.—Catalogue No. 20C (20 pages) giving a full description, with half-tone pictures and special diagrams of connections, of their Peebles motor converters. One of the views shows the interior of one of the sub-stations of the Calcutta Electric Supply Corporation, Ltd., with six out of the 19 475-KW. three-bearing sets that have been supplied to this company. Names of other important users are also tabulated. During the past 18 months orders have been received for over 60 sets in sizes ranging from 1,500 KW. down to 100 KW.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—Catalogue No. 505 (20 pages) contains excellently illustrated descriptions of their distance thermometers and hygrometers, their principles and practical applications, together with tabulated prices, temperature conversion table and a telegraphic code.

THE WESTINGHOUSE COOPER-HEWITT CO., LTD., 80, York Road, King's Cross, London, N.—List No. 56 particularising and giving prices and a light distribution curve of their silica lamps for D.C. for foundry, workshop, railway siding and other such lighting. A guarantee is given of a minimum life of 1,000 hours. Another size of lamp, viz., 2,500-C.P. unit for 110 volts, has been added.

MESSRS. WRIGHT & WOOD, LTD, Century Works, Pellon Lane, Halifax.—Catalogue consisting of a number of lists in expanding binder, containing brief specification matter, together with illustrations, tabulated sizes, prices, shipping and other particulars, of D.C. and A.C. motors, D.C. and A.C. starting gear, motor-generators, converters, electric saw benches, and polishing machines.

MESSRS. ARNOLD & LARGE, LTD, Wolverhampton.—Mail card giving illustrated particulars and prices of their "Arno" power punching press.

THE GENERAL ELECTRIC CO, LTD, London.—Leaflet O 1,701 dealing with battery fans, and an ingenious electrical novelty for shop-window advertising.

MESSRS. KRUPKA & JACOBY, LTD., 26-36, Chapter Street, Westminster, S.W.—New leaflet illustrating and pricing their single light weatherproof lanterns for round metal-filament lamps of from 100 to 1,000 C.P.

MESSRS. SANDYCROFT, LTD., Sandycroft, near Chester.—Twenty-page illustrated catalogue, giving particulars and tabulated data respecting their storage batteries. The types shown include the B.N. lighting cells, A.N. central station type, and Sandycroft car lighting cells. Prices and dimensions, &c., are given. The Sandycroft connecting bolt for battery lugs is shown, as also are views of Planté type positive and box type negative plates.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown, E.—36-page catalogue containing an admirably illustrated account of the various departments of the business of this well-known company. General notes respecting the progress of the company, and of Silvertown itself, are followed by information respecting the india-rubber department, the ebonite department, the gutta-percha department, submarine cable department (with brief notes concerning cable-laying achievements of the company), the electrical department, also the mechanical and testing departments. We are sure that many of our readers at home and abroad will be interested in a perusal of this brochure.

Trade Announcements.—MESSRS. CREDENDA CONDUITS CO., LTD., of Birmingham, ask us to contradict the rumour which is in circulation in London to the effect that Messrs. Baxter and Caunter, Ltd., have ceased to represent them as their sole agents, as there is no truth whatever in the statement.

THE LONDON ELECTRICAL TRADING CO., LTD, notify that their new address is 185, Wardour Street, W., and their telephone number "2830 Regent."

Liquidation.—H. A. HARVEY & CO., LTD., London.—The first meeting of creditors will be held at Carey Street, W.C., on July 30th, at 11.30 o'clock.

Bankruptcy Proceedings.—WM. WADSWORTH, 16, John Dalton Street, Manchester, engineer's agent and dealer in electrical accessories.—First meeting, July 28th, public examination, August 15th, both at Manchester.

JOSEPH PERKINS, electrical engineer, Plymouth.—Release of trustee, dated March 6th, 1913.

LIGHTING and POWER NOTES.

Aberdare.—L.G.B. INQUIRY.—Last week Mr. Hooper held an inquiry into the application of the Council to borrow £2,453 for electricity purposes.

Acton.—STREET LIGHTING.—The minutes of the Highways Committee, submitted to the U.D.C. last Tuesday, contained a report by the surveyor on the clauses referring to the engineering part of the new scheme for main street lighting, which he had provisionally agreed with Mr. Prangnell, of the Metropolitan Electric Supply Co., providing for the installation of 450-C.P. lamps specifying a minimum luminosity, and penalties if it fell below. From the amended clauses of the company, it appeared that the company was prepared to install lanterns similar to those in the Hanwell district, but with lamps of 400 C.P., and would only agree to penalty clauses for diminished luminosity in consideration of increased payment. The Committee had instructed the clerk to forward a copy of the clauses provisionally agreed between the two engineers, and inform them that the Council adhered to the stipulation that 450-C.P. lamps be installed with a minimum luminosity of 90 per cent., and required the inclusion in the agreement of a clause providing for a penalty should the luminosity upon a specified test be found to be below such minimum.

Alloa.—From the annual balance-sheet of the electricity department of the T.C., it appears that the profit realised was £933, as compared with £588 in the previous year.

Australia.—The Melbourne City Council recently proposed to supply power free of charge to a leading city club for cooking, on condition that the Council's officers were given the opportunity to obtain data and information on the subject for comparison with gas.

According to *Tenders*, the North Sydney Municipal Council has again discussed the proposal to allow a company to supply electricity for street and private lighting. Opinions of counsel were read to the effect that the municipality had no power to enter into the proposed agreement. Our contemporary adds, "This seems to be the death-blow to the scheme."

The Federal Government is reported to have definitely decided upon a site on the Shoalhaven River, N.S.W., between Warri and Bombay, for the construction of a reservoir in connection with the supply of electricity for the Federal capital. The site is about 40 miles from the capital.—*Tenders*.

Ayr.—SUPPLY TO ADJOINING AREAS.—Negotiations have been concluded between the Corporation and the burgh of Prestwick, whereby the former's electric lighting system will be extended to Prestwick, the latter having agreed to support a prov. order authorising the extension. Arrangements have also been made with the County Council District Committee for extending the system to Burns Cottage and Alloway. The communities in each district are to be supplied at the same price as the consumers in the burgh of Ayr.

Blairgowrie.—PROV. ORDER.—Messrs. Foote & Milne have intimated to the T.C. that they intend applying to the B. of T. on or before December 31st for a provisional order to supply electricity within the T.C.'s area.

Bolton.—LOAN SANCTION.—The Electricity Committee has received the sanction of the L.G.B. to the borrowing of money for the new generating station at Back-of-th'-Bank. The amount is divided up as follows:—Buildings, £2,583; reservoirs, £8,999; pipes and valves, £2,450; chimneys, £5,670; sub-station gear and transformer, £2,737; machinery and cables, £1,828; travelling crane, £1,110; electric light wiring and fittings, £522; motors and cables, £530; storage battery, £475.

Bristol.—L.G.B. INQUIRY.—A L.G.B. inquiry was held on July 15th into the application of the Corporation for sanction to borrow £25,000 for mains, sub-stations, house services, &c., for the next three years. The local Ratepayers' Association opposed the application, urging that the undertaking was "extravagantly managed," &c., and pointing out that the Corporation was proposing to supply 1,100 street lamps free of charge, from which the Association assumed that excessive plant had been provided.

Buckhurst Hill (Essex).—PROV. ORDER.—The Council has been notified of the intention of the County of London Electric Supply Co. to apply for a prov. order for electric light.

Carlisle.—The net profit on the electricity undertaking last year was £1,509, but abnormal expenditure of a capital nature, increased coal charges and rates, were met during the year.

Chadderton.—The Oldham T.C. has applied for power to supply current in the Chadderton district.

Clitheroe.—PROV. ORDER.—On July 17th a letter was read in Council from Mr. J. W. Speight, stating that he intended on behalf of a company, to be called "The Clitheroe Electric Supply Co.," to apply to the B. of T. for a prov. order. Mr. Speight has given similar notice to Rishton Council.

Continental Notes.—GERMANY.—The new electricity generating station of the Rhenische-Hessischen Electricitätswerk, at Osthofer (Hessen), has just been put in operation; it is supplying the necessary current for lighting purposes in no fewer than 131 small towns and villages in the district.

NORWAY.—The Bistavarre Copper Mines Co. has secured a concession from the Norwegian Government to utilise the water-power of the Goulasjoure and Goulaschok waterfalls at Lyngen, Norway. It is stated that between 14,000 H.P. and 15,000 H.P. will be available.

POLAND.—La Station d'Electricité de Sosnowice is the name of a new company which is being formed at Sosnowice, Poland, with a capital of 4,000,000 roubles, to acquire and carry on the electricity supply station which has been established in conjunction with the Count Renard Collieries.

SPAIN.—La Sociedad des Fuerzas Hidraulicas del alto Pirines is the name of a new company which has just been formed in Barcelona, with a capital of £40,000, to utilise certain available water-power in the Upper Pyrenees. The Compagnia Energia Electrica de Cataluna, of Barcelona, is interested in the new undertaking.

Cromer.—B. OF T. INQUIRY.—On July 15th an inquiry was held relative to the proposed transfer of the electric lighting undertaking of the U.D.C. to Edmundson's Electricity Corporation, Ltd. What opposition there was, was not against the transfer, but with regard to the terms.

Deal.—PROV. ORDER.—Messrs. Foote & Milne have informed the T.C. that they intend applying for a prov order for electric lighting.

Doncaster.—L.G.B. INQUIRY.—An inquiry was held on July 22nd into the application of the Corporation for powers to borrow £12,500 for the provision of further plant in connection with the electricity undertaking.

Dungarvan.—The scheme which the Council is considering for the electric lighting of the town is likely to cost about £2,600. A Cork expert has been called in to pronounce on the scheme.

Dunstable.—PROV. ORDER.—The T.C. on Friday received notice that Messrs. Foote & Milne, of London, intended to apply for a prov. order for electric lighting. The Council decided to oppose the application, it being intimated that any electricity scheme for the town would be carried out by the Council.

Easingwold.—PROV. ORDER.—The York T.C. has informed the R.D.C., that it intends applying to the B. of T. for a prov. order for electric lighting within the Council's area. It is understood that there will be no objection on the part of the R.D.C.

Galashiels.—PROV. ORDER.—At a meeting of the T.C., the Galashiels and District Electric Supply Co. intimated its intention within the year to apply for a provisional order.

Greenock.—The Caledonian Railway Co. proposes introducing electric light at the Greenock central station, Ladyburn engine-shed and Port Glasgow, and 30,000 units per annum will be required.

Isleworth.—WORKHOUSE LIGHTING.—Respecting the question of lighting the Union workhouse buildings at Isleworth by electricity, the Brentford Guardians have adopted a recommendation by their Engineering Committee to engage an expert, at a fee not exceeding 25 guineas, to advise as to the best means of obtaining the current required.

Jersey.—PROPOSED ELECTRICITY SCHEME.—St. Helier, the capital town of Jersey, is one of the few holiday resorts which does not possess a public electricity service. The question has received attention at different times, and in the early part of this year the Gas Co. retained the services of Messrs. May & Hawes, consulting engineers, who have prepared a complete scheme for the establishment of an electric supply undertaking for the town. Upon the strength of this scheme, application has been made by the Gas Co. to the States for the necessary powers, and to the Parochial Assembly for the usual facilities for undertaking the various works to carry the scheme into effect.

In submitting their proposals to the Parochial Assembly, the Gas Co. point out that the British Parliament and the B. of T. are showing themselves favourable to a dual control, by the number of Acts and Electric Supply Orders which have been granted to English gas companies. The company have offered to submit the scheme to the Board of Trade for examination and approval, and undertake to commence constructional operations immediately the powers are granted, and to start the supply of electricity within two years at latest upon a scale of charges not exceeding the rates of 5d. per unit for residential lighting, 4½d. per unit for business lighting, 1½d. per unit for power and heat, with special rates for large and high load-factor supplies. Slot meters will be available for the smaller classes of property, and public lighting will be undertaken if required by the parochial authority, as is likely to be the case for a few of the principal streets.

The town of St. Helier has a population of over 20,000, but like most similar holiday resorts, it suffers from a very short "season." It is proposed to establish the undertaking on the direct-current, three-wire system, with a pressure of 240 volts for lighting, and 480 volts for power purposes. The generating station will be erected on the site of the old gas works. For the initial equipment two generating sets will be provided, each of 200 KW. capacity, and there will be a large battery capable of dealing with the entire supply for a prolonged period, while provision is to be made both as regards accommodation and the design of the principal auxiliary plant for the introduction of a third generating set of 200 KW. capacity as soon as the demand necessitates it. Underground mains will be used throughout. As part of the compulsory works, the company have undertaken to lay down at the commencement 1½ miles of feeder mains, and 4½ miles of distributing mains in the principal streets of the town.

It is almost unnecessary to add that the electric light is likely to be a valuable asset to the town, in view of the numerous visitors, and under modern conditions there is no reason why it should not be the cheapest form of lighting in most cases.

Keynsham.—STREET LIGHTING.—The P.C. has accepted the tender of the Keynsham Electric Light and Power Co. for public lighting from August 10th to May 10th at £274 5s.

Kimberley.—PROV. ORDER.—A prov. order for electric lighting is being applied for by the Notts. and Derbyshire Electric Power Co.

Kingston-on-Thames.—The last completed year's working of the electricity undertaking shows a net loss of £1,255. The abnormal price of coal accounted for £1,093 of this; the department will shortly have more efficient plant in use, and may ultimately make a better showing.

London.—ST. PANCRAS.—ANNUAL ACCOUNTS.—The gross income of the electricity undertaking during the year ended March 31st last amounted to £90,539, which is an increase of £5,324 over 1912. After paying all working expenses, repayment of loans, interest, &c., and providing for accrued charges, a profit remains on the year's working of £10,685, this being a decrease of £1,751 on 1912. To this profit the balance of £6,307 from last year is added, increasing the balance to credit of net revenue account to £16,992, of which £4,000 is to be retained as a working balance. The balance in hand at the commencement of the year was £41,465 to which is added £1,197 for interest on investments during the year, which makes a total credit of £42,662 in the fund at March 31st, 1913. This balance is represented by cash at the Council's bankers, and £32,509 the balance of loan advanced to the electricity capital account. The capital expenditure out of loan to March 31st, 1913, is £563,582, and the expenditure provided out of revenue and reserve, including £1,040 spent during the year, is £8,154. The total number of units generated during the year amounted to 11,674,023; 10,214,668 of which were sold. The lighting of Euston Road is to be improved by the introduction of 18 modern flame arcs, and the erection of an additional lamp at King's Cross Circus. The question of improving the lighting of the main roads of the borough is under consideration.

HAMMERSMITH.—The B.C. electricity undertaking shows a surplus profit on last year's working, after deducting the equivalent of a penny rate already allocated, of £4,540, and of this sum £2,500 is to be carried to the reserve and invested accordingly. The B.C. has also decided that £250 be set aside from the revenue account as a further allocation of the scheme for supplying on hire wirings and fittings required for external lighting.

STEPNEY.—The L.C.C. has sanctioned the borrowing by the Borough Council of £25,000 required in connection with the Limehouse station extensions. In anticipation of further extensions at the above-mentioned station, it is proposed to acquire property, including certain mooring rights, at a cost of £4,800. Nottingham Corporation has offered to supply the Council with 198 demand indicators at the rate of 12s. 6d. per instrument, the Council to pay the cost of carriage. It is proposed to accept the offer provided the Corporation reduces the cost of the instruments to 10s. each.

HACKNEY.—The Council's agreement with L. Berger & Sons, Ltd., to supply between 300,000 and 500,000 units per annum, is to be extended for a period of two years.

LEWISHAM.—The B. of G. has applied to the L.G.B. for a loan of £1,750 for installing electric light at the workhouse and the infirmary.

Luton.—L.G.B. INQUIRY.—On Friday Mr. R. H. Hooper held an inquiry into the application of the T.C. for a loan of £44,296 for electricity purposes. There was no opposition.

Macclesfield.—ELECTRICITY SCHEME.—A start has been made by the New Electricity Co. of Macclesfield, Ltd., in the matter of providing a supply of electricity for the town. A contract has been accepted for the conversion of a dye house in George Street, Pickford Street, into a generating station, and two Diesel engines are to be installed.

Norwich.—ANNUAL REPORT.—The Electricity Committee of the T.C. reports that the progress of the undertaking was well maintained during the past year, the increase in the output being 871,627 units. The expenditure of the past year amounted to £20,849, and the balance for the year was £1,688. The interruption to business occasioned by the great Norwich flood in August involved a loss of about £500 in revenue, while £599 was expended in effecting repairs to machinery and mains and generally putting things straight. The cost of the coal consumed last year was £1,727 more, showing an increase of nearly 20 per cent. The number of new consumers was well above the average of previous years. The 2,000-KW. turbo-generator, ordered in the early part of 1912, has not been completed, and it has, accordingly, not been possible to realise the reduction in coal consumption which was anticipated. The re-erection and partial reconstruction of the boiler house adjoining the Wensum has been completed; the work has involved the replacement of five small boilers by two large boilers equipped with mechanical stokers and giving double the evaporative effect. The work has further involved the rearrangement of the economisers and the addition of an induced draught fan to assist the action of the chimney; also the erection of overhead coal bunkers with a conveyor for handling the coal and ashes. No further generating plant will be required this year, but to meet the require-

ments of the winter of 1914-15 the Committee is taking steps to provide a turbine of 3,000-KW. capacity, to be delivered 12 months hence.

Nuneaton.—WORKS EXTENSIONS.—Last week a new 700-H.P. turbo-generator of B.T.H. make was formally started up in the presence of members of the Corporation; the works were thrown open to the public, and subsequently an electrical cooking demonstration was held.

Reigate.—PROV. ORDER. — Mr. Gilbert Allom has informed the R.D.C. of his intention to apply to the B. of T. for a prov. order for electric lighting within the parishes of Walton-on-the-Hill and Kingswood.

Rickmansworth.—PROV. ORDER.—The U.D.C. has received notices from Mr. R. E. H. Fisher and the Colne Valley Electric Supply Co. of their intention to apply to the B. of T. for prov. orders for electric light.

St. Anne's-on-Sea.—ANNUAL ACCOUNTS.—The municipal electricity undertaking, according to the annual statement, has enjoyed a record year. The gross profit was £5,597, as against £5,180, which is equal to 10·55 per cent. on the capital. There was an increase of 68,651 units sold, and of 150 consumers. Out of the gross profit of £5,597, the sum of £2,066 has been repaid on loans, £1,261 has been paid in interest, £700 has been transferred to district fund, £155 to reserve fund, £275 for meters, &c., and, after certain other allocations, a balance of £490 has been carried forward. The output sold was 939,343 units to 1,281 consumers. The reserve fund amounts to £5,365, being the statutory limit of this fund.

The wardens and officials of St. Thomas' Church have decided to install a clock in the church tower. The cost of the clock and chiming gear is estimated at £202. The clock, which will have three skeleton dials, each 6 ft. in diameter, will be worked by electricity.

Sandiacre (Derbyshire).—PROV. ORDER.—The P.C. has received notice from the Notts. and Derbyshire Electric Power Co. of the latter's intention to apply for the necessary powers to introduce electricity into Sandiacre and other Derbyshire towns.

Shoeburyness.— The Southend-on-Sea T.C. having applied for consent to supply current to a residence in the town, the U.D.C. has intimated its assent, provided it is paid £4 a year, representing the estimated profit if the residence was supplied with gas. The T.C. has replied that it is not prepared to accept the condition which involved consent for any payment of a monetary consideration, and the U.D.C. has answered that it is not prepared to consent without some consideration. The Southend Council has communicated with the B. of T. on the matter.

Swinton.—Upon the suggestion of Mr. Busbridge, the electrical engineer, the Council has decided to convert 10 gas lamps in Chatsworth Road, Broad Oak Park, to electric lamps, at a cost of £40.

Tyldesley.—The Lancashire Electric Power Co. is engaged in laying cables in the streets, and in the erection of a transformer house. The company, to whom the D.C. transferred its rights of public supply some years ago, intends to take current from the tramway company until such time as it is in a position to give a supply from its own power station at Radcliffe. It is expected that a supply will be available to consumers within a month or so.

West Ham.—ANNUAL ACCOUNTS.—There is a net profit of £2,008 on the working of the electricity department during the year ended March 31st last. The total working expenses (including discounts, allowances, bad debts, rates and central administrative charges) amounted during the 12 months to £71,612, as against £64,743 in the previous year, showing an increase this year of £6,868, principally accounted for by the additional business and the increased price of coal over a strike period. The total income for the same period was £110,154, as compared with £102,438 in the present year, showing an increase of £7,716 on the general sale of current, &c., after allowing for the decreased income of £5,804 from traction due to a reduction in the charge per unit to the tramways department. After taking the above items into consideration, there is a gross profit for the year of £38,543, as against £37,695 in 1912, being an increase of £848. The gross profit per unit sold amounted to ·34d., as against ·38d. in the previous year. This difference is not so large when it is considered that for the period under review the maintenance of public lamps has been deducted from income. As compared with 1912, the percentage of total revenue to capital outlay shows ·24 per cent. decrease; and the working, &c., expenses an increase of ·06 per cent; or a decrease of ·30 per cent. in the gross profit on capital outlay. With regard to the sales department there was a trading surplus of £2,008, after charging the proportion of the central administrative expenses, rents, depreciation and interest loans applicable thereto, but the heavy charges for repayment of debt (for very short period loans, now nearly paid off) brought about a net deficit of £985. The total number of units generated during the 12 months amounted to 33,974,343, of which 27,466,098 were sold; 3,020,684 for private lighting; 17,625,343 for private power and heating; 716,187 for public lighting; and 6,103,884 for tramways. In considering the accounts of the undertaking, the Electricity and Tramways Committee reminds the Council that there is no reserve or renewals fund to meet any future demands for replacements of any portion of the assets required before the expiration of the loan periods, and states that it is a matter for serious consideration in view of the fact that the undertaking has not been realising sufficient surplus during the past years to make such provision.

Ystradgynlais.—PROVISIONAL ORDER.—At a meeting of the District Council the clerk reported that he had received notice from the Advisory Engineers' Corporation, Ltd., that they intended to apply to Parliament during the next Session for a prov. order for the district. He added that the Council had entered into an agreement with the Glantawe Electric Light Co. to give the supply, and the best thing for the Council to do was to apply for the prov. order itself. It was agreed to communicate with the Council's Parliamentary agents in the matter

TRAMWAY and RAILWAY NOTES.

Australia.—It is suggested that the W.A. Government will arrange for the electrification of the railway between Perth and Northam, at an estimated cost of £70,000, and adopt road tractors as a temporary substitute for feeder railways in county districts.

Baildon (Yorkshire).—It was reported at a meeting of the D.C. last week that the Bradford Corporation Tramways Committee had declined to further consider Clauses 4 and 7 in the draft agreement in regard to the proposed extension of tramways from Shipley to Baildon. Mr. J. W. Whittaker suggested that there was a misunderstanding in regard to the interpretation of the clauses, and asked that the correspondence concerning the clauses be read. Mr. A. J. Greenwood said the Bradford Corporation did not come forward and deal with the matter like business men, because they were disgusted with the way the Baildon Council had acted. A motion to have the correspondence read was defeated.

Birkenhead.—ANNUAL REPORT.—The report of the traffic manager (Mr. C. Clarke) shows that the past year has created a record as regards passengers carried, traffic receipts and net profit. The traffic receipts amounted to £61,190, advertising receipts £800, miscellaneous receipts £76, bank interest £85, giving a total income of £62,153. Working expenses amounted to £36,358, leaving a gross profit of £25,791. Of this, interest on capital, &c., absorbed £11,808, and instalment to sinking fund, &c., £9,684, leaving a net profit on the year's working of £4,301, which has been placed to renewal fund account. This account has now to its credit £18,069. The passengers carried numbered 13,622,361; the car-mileage was 1,235,277, and the income per car-mile 12·074d., the net profit per car-mile being ·835d.

Continental Notes.—ITALY.—It is reported from Milan that the authorities of the province of Alessandria have concluded a provisional agreement with the Italian Westinghouse Co., the Alessi Construction Co., and the Entreprise Générale des Travaux Publics (E. A. Drake), in regard to the construction and working of a large network of tramways in the province. It is proposed in the first place to establish 15 lines of a total length of 233 miles, and application for a concession for these lines has already been made to the Government. The concession is to be for 60 years, and the authorities of the province and the local authorities interested, will grant an annual subsidy of £85 per mile of route for a period of 30 years, and will also guarantee the interest on the loans to be issued. It is subsequently intended to build two further groups of lines of a total length of 186 miles, although the traffic is to be provisionally dealt with by the establishment of a service of automobiles, which will have the benefit of a subsidy of £64 per mile of route served. In return for the subsidies, which are to be raised by the levy of additional taxation in the province, the latter will participate in the receipts from working to the extent of 4 per cent. The power for operating the tramways is to be derived from the waterfalls of the Serivia and the Orba.

Plans are being prepared in respect of a projected electric railway between Aosta and Prè St. Didier.

SWITZERLAND.—A company has just been formed at Sierrè with the object of constructing an electric railway from that town to Goppenstein, a distance of about 15½ miles. The line, which will pass through the valley of the Rhone, will commence at an altitude of 1,750 ft., and terminate at 3,920 ft. above sea level. The trains will be hauled by electric locomotives, using single-phase current.

Coventry. — ANNUAL ACCOUNTS. — The Corporation Tramway accounts cover two consecutive periods of 3 and 12 months' working respectively, representing the 15 months' working since the undertaking was taken over by the town. The revenue for the 12 months ending March last (9·45d. per car-mile) was just over £39,000; the gross profit was £15,000, and with three months' profit brought down, left £17,984 to net revenue for the 15 months. This provided £10,379 interest; £3,286 sinking fund for 8 months; £2,876 to reserve in lieu of the previous 7 months' sinking fund, and a net balance of £1,443, which was appropriated for various capital expenses. The year's working covered 994,207 car-miles, 7,639,000 passengers being carried. The power station supplied 1,475,211 units at a works cost of ·45d. per unit. The route-miles of track of the system were 13.

Dartford.—Messrs. Balfour, Beatty & Co. have applied to the B. of T. for an extension of time until August 18th, 1915, for the completion of the tramways authorised by the Dartford and District Tramways Order, 1911.

East Kent.—The Light Railway Commissioners on Friday held an inquiry at Dover respecting the application of the East Kent Light Railway Co., for powers to extend new lines from Snowdown Colliery to Woodnesborough, from Mongeham to Deal, connecting up the Betteshanger Colliery area, from Wingham and Wickham to Canterbury, and in the Alkham Valley. The application with respect to Snowdown and Woodnesborough, was adjourned through opposition, the Commissioners deferred their decision respecting the Mongeham to Deal line, in order to view the route; and the other applications were sanctioned.

Edinburgh.—The local tramwaymen have struck work with a view to obtaining ½d. per hour increase in wages; the tramway service has been suspended.

Huddersfield.—The Tramways Committee proposes to purchase five new cars in order that proper and comfortable accommodation may be provided for the residents of Lockwood and Moldgreen.

Japan.—A charter has lately been granted by the Japanese Railway Board to the Onsen Electric Railway Co. for the construction and working of a light electric railway between Kanan, Komatsu, Naya and Dohashi, in the Prefecture of Ishikawa. The line will have a gauge of 3 ft. 6 in., and be about 14 miles long.

Manchester.—A record was made last week when the King and Queen visited the city. No fewer than 825,703 passengers were carried on the tramcars during the day, the previous highest being 698,913, on August Bank Holiday, 1908. The receipts were £4,079, as against £4,144 on August 3rd, 1908. The figures are remarkable, Mr. McElroy, general manager, points out, because no fewer than 110 cars were out of service carrying school children, and the car service was at a standstill part of the day.

Morecambe.—The Tramways Committee has instructed the borough electrical engineer to prepare an estimate for the electrification of the horse tramways.

Northampton.—PARCEL SERVICE.—A parcels delivery system has just been inaugurated in connection with the Corporation tramways by the manager, Mr. J. A. Gottschalk. A shop in the centre of the town has been leased for the purposes of a depôt, and the system has been attended with great success. The reconstruction of the South Bridge, Northampton, has been almost completed, and when this and the widening of Bridge Street have been effected, the tramways are to be extended to Far Cotton, a suburb of the town which is at present served by horse 'buses.

Oldham.—Upon the occasion of the King's visit to Oldham, the takings for the day on the tramways were easily a record. The receipts were £727.

Salford.—ANNUAL REPORT.—The result of the working of the tramways for the year ended March 31st last shows that there is a gross profit of £99,766, which, with the £5,659 for interest on investments, &c., makes a total available balance of £105,426. This sufficed to meet loan and interest charges, to provide £22,000 to the rates, £9,374 for renewals and certain items of capital expenditure. The passengers carried, mileage covered, and receipts are well in excess of previous years. The number of passengers carried was 50,113,120, an increase of 1,392,332. The receipts were £259,704, an increase of £6,389; and the mileage covered was 5,854,830, an increase of 46,461. The Corporation operates over 75 miles of line in eight different areas.

Southend-on-Sea.—PROPOSED LOAN.—The T.C. intends applying to the B. of T. for sanction to borrow a further sum of £16,900 for tramway purposes.

Swansea.—EXTENSIONS.—An application was heard by the Light Railways Commissioners, on Tuesday, for a provisional order empowering the Corporation to construct three light railways of a total length of about three miles within the borough, at an estimated cost of £33,000 on construction and equipment and £30,000 on road widenings. The railways, which are to be electrically worked under an agreement with the Swansea Improvements and Tramways Co., are designed to develop the Corporation Town Hill Estate for building purposes, and railway No. 1 is up Mount Pleasant, which, in parts, has a gradient of one in eight. Mr. Stephen Sellon assured the Commissioner that the line could be worked, especially with the "gripper" brake as used on the Highgate system, with absolutely safety. The promoters were represented by the town clerk, and five of the frontagers objected on minor grounds. The Commissioners intimated that the report would be communicated later.

West Ham.—ANNUAL ACCOUNTS.—The accounts for the year ended March 31st last show a deficit of £3,388 on the working of the tramway undertaking. This compares with a surplus of £4,082 in 1912 and of £6,923 in 1911. The gross expenditure for the 12 months amounts to £110,049, from which has to be deducted a sum of £1,236 for proportion of costs due from other authorities in connection with through-running, leaving the net expenditure at £108,813, being an increase of £5,115. The total income amounted to £139,298, from which a deduction of £856 has also to be made in respect of proportion of receipts due to other authorities in connection with through running, leaving a net income of £138,441, against a corresponding figure in 1912 of £140,115 or a decrease of £1,673. This leaves a gross profit of £29,628, as against £36,417. The net income per car mile works out at 9·409d. as against 10·228d. in 1912, and the net working costs at 7·368d. as against 7·570d., leaving a gross profit per car-mile of 2·041d. as against 2·658d. The deficit is to be charged against the reserve fund.

The Council is supporting the Croydon Corporation in its application to the Government, urging them to pass such legislation as will place motor-'bus companies on terms of equality, with regard to public obligations, with tramway authorities in the Metropolitan area.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Judicial Committee of the Privy Council has refused the petition of the Commonwealth Government for special leave to appeal against the decision of the High Court, authorising the Marconi Co. to inspect the plant erected by the Government in its wireless stations under Mr. Balsillie's patents.

Imperial Communications.—An Imperial Communications Committee has been formed at the House of Commons, to continue the work carried on by Sir J. Henniker Heaton in Parliament for the improvement of postal and telegraphic communication throughout the Empire.—*Times.*

Imperial Wireless System.—Replying to questions in the House of Commons, Mr. Samuel stated that as the Imperial stations would be State-owned, it was very improbable that licences would be granted to private companies to erect competing stations in the same countries; but where the question of competition did not arise, licences would be granted to British companies of good standing. The delay which had already occurred was an additional reason against further delay in erecting the stations.

A debate took place in the House of Commons last week on a motion for the adjournment of the House, to call attention to the refusal of the Postmaster-General to allow any company other than the Marconi Co. to submit a tender for the erection of the Imperial stations. The mover, Mr. W. Guinness, contended that the Goldschmidt and Poulsen companies should be allowed to compete. Major Archer-Shee, in seconding the motion, stated that the United States Government had chosen the Poulsen system after testing its working over 1,800 nautical miles, and asked for delay to enable the best system to be selected. In his reply, Mr. Samuel referred to the difficulty of maintaining communication over long distances in the daytime, and mentioned that in 1907 the Poulsen Co. assured the Post Office of their ability to establish a thoroughly satisfactory service to America, but nevertheless they had not yet established any trans-Atlantic service. Communication between San Francisco and Honolulu by day was not yet (July 12th) in operation. The official demonstrations of the Goldschmidt system between Hanover and Slough, before Lord Parker's Committee, were failures. Both systems were of considerable promise, but not of proved capacity. It was essential that the stations should be of the highest efficiency and reliability. While other stations were said to be cheaper than the Marconi stations, the latter were to be duplex, and no other company was able to work duplex. In his opinion the situation had not changed since August, 1911, when a Departmental Committee decided not to invite tenders, because the Marconi Co. alone could be depended upon to do the work. He had obtained that day the opinions of the Engineer-in-Chief of the Post Office, the Inspector of Wireless Telegraphy, the President of the Institution of Electrical Engineers, and Lord Parker, who all reported to the effect that it was not advisable to employ either the Poulsen or the Goldschmidt system at the present time. Lord Parker stated that the Committee did not consider that the adoption of any system other than the Marconi system was a practical proposition, having regard to the evidence before them. If the Government intended to act on the report of the Advisory Committee, said Mr. Samuel, it would erect at least the first two stations on the Marconi system, and unless the work was done by the Government, the only alternative appeared to be the employment of the Marconi Co. It was impracticable to proceed with the buildings before the system was decided upon, for the buildings could not be erected unless the sites were chosen, and the contractors naturally would not guarantee success unless they had a voice in the selection of sites. Six months ago the Parliamentary Committee reported that it was a matter of urgency that a chain of Imperial stations should be established, and not a sod had yet been turned. Surely it was time to make an end.

Mr. Austen Chamberlain said that the Government had acted as though the Marconi Co. were their masters, whereas the contrary was the case. He did not like the management of the Marconi Co., and considered their claim for an increased price an impudent one.

On Wednesday last week, Mr. Samuel stated that the Universal Radio Syndicate had proposed, in March, to demonstrate the working of the Poulsen system between the Eiffel Tower and Arlington, U.S.A., and the Foreign Office obtained the permission of the French Government for the trial to be made; but it was found impracticable to install the necessary apparatus at the Tower station. He was not aware that the Poulsen Syndicate in this country could avail itself of the patents used in the American

Poulsen service. The Goldschmidt system was in a purely experimental stage at present. Each Marconi station required 12 masts, costing about £33,000 per station; the Goldschmidt system used one very high mast, about 36 low masts and three brick towers, and the aerial was not directional. Regarding the urgency of the matter, he said that the first comer would have free choice of wave-length and of site without considering questions of interference with contiguous stations, and, above all, would be equipped against the risk of war when other nations were not. A payment outright for the use of patents was evidently less advantageous than an annual royalty, which could be discontinued at any time if the use of the patents was dispensed with.

The admission of any other company's tender would result in delaying the whole matter until next year. Any demonstration must be continued for a sufficient length of time to show that the wireless communication could be maintained during atmospheric disturbances.

Mr. Baxendale, managing director of the Universal Radio-Syndicate, Ltd. (Poulsen system), addressed a long letter to the daily Press last week "to correct a few of the more serious misstatements made by Mr. Samuel" on the 16th inst. Amongst other items, he mentions that the United States Government is paying for the Poulsen station which is to be erected at Panama, and is satisfied that its range will be half as long again as that of any station of the Imperial chain; and that a regular daylight service is being maintained from San Francisco to Honolulu, but not in the opposite direction, owing to the non-completion of the station at Honolulu. Further, Mr. Baxendale states that the English company owns the Poulsen patents for almost the whole world, exclusive of the United States and their dependencies, and is entitled to all improvements made by the American company. A reply from Mr. Samuel was published on the following day, in which he quoted the report of the Advisory Committee, and pointed out that the president of the American company stated on oath that the English company had no such right to the American improvements as was claimed.

On July 23rd a rejoinder appeared from Mr. Baxendale, renewing his statements that a 100-KW. generator had been installed at San Francisco, and was working satisfactorily day and night, and that Dr. Austin had found the arc superior to the spark at distances between 1,400 and 2,100 miles; and pointing out that the president of the American company himself corrected the mistaken statement that the English company was not entitled to the American improvements.

On 22nd inst, Mr. Samuel, in reply to questions, stated that when the Marconi patents expired, the royalties would cease. The cost of the plant covered by the patents would be about 16 per cent. of the total estimated cost of each station, excluding the buildings. The Poulsen plant at the Cullercoats station was purchased at a price that was agreed upon, and approximated to that asked by the vendor.

Mongolia.—A Scotsman named Grant, employed on telegraph duty in Mongolia, was recently murdered by natives; he defied his captors to the last with undaunted courage. The Chinese Government has promised to provide handsomely for his mother.

The War Office and the Poulsen System.—A deputation from the War Office Wireless Committee, comprising Sir Henry Norman, M.P., and Commander Silvertop, accompanied by Captain Lefroy, R.E., who is in charge of the experimental wireless work at Aldershot, has visited Vienna to inspect the manufacture and working of the Poulsen apparatus. Military sets were shown working over a distance of 40 miles, and the Poulsen station at Ober-Laa, near Vienna, which is being erected in order to enable the military authorities to communicate with the military and naval ports of the Monarchy, was visited. On the homeward journey the Goldschmidt station near Hanover, and the station at Laeken, near Brussels, will be inspected.—*Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Alford (Lincs.).—July 28th. Public lighting for the U.D.C. Mr. Thos. N. Loy, clerk.

Australia.—VICTORIA.—August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 9th.—Common-battery multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

QUEENSLAND.—September 10th. Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

NEW SOUTH WALES.—August 20th. Pneumatic ash-handling plant for the White Bay power house. Specification No. 415 (5s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Austria.—PRAGUE.—July 30th. Installation of the electric light at the railway station at Weinberg, on the basis of unit prices. Forms and conditions, K. K. Staatsbahndirektion, Prague.

July 28th.—Electric lighting and power installation for the railway workshops at Bodenbach. Particulars of Abteilung IV, and tenders to K. k. Staatsbahndirektion, Prague.

TOPOLAY.—July 31st. Tenders for a concession for 50 years, to install and work a public and private lighting service. Deposit, 5 per cent. Gemeindeamt, Topolay.

DROHOBYCZ.—July 31st. Installation of a power station in the prison at Drohobycz. Deposit, 5 per cent. K. K. Oberbauleitung der Justizbauten in Lemberg.

Belgium.—BRUSSELS.—July 30th. Supply of electrical material to the State Railways. Salle de la Madeleine, Brussels.

July 30th.—Supply and erection of two cables, with accessories, to connect the telephone exchanges at Brussels and Antwerp; and two cables to connect the two telegraph-telephone lines at Verviers, starting from Ans (Cahier des Charges Special No. 156). Salle de la Madeleine, Brussels.

Blackburn.—August 2nd. Steam coal for the Electricity Committee, for 12 months ending August 31st, 1914. Mr. P. P. Wheelwright, engineer and manager.

Bristol.—Overhead electric travelling gantry, Bathurst Wharf, for the Docks Committee of the T.C. The Engineer.

Chile.—September 13th. (1) An electric generating plant with distributing system; (2) an electric lighting installation—both for the harbour of Valparaiso. Tenders to "Al Sr. Secretario de la Comision, Comision de Puertos, Calle Santo Domingo No. 1,147," Santiago de Chile, where the specifications, &c., may be consulted.

SANTIAGO.—August 9th. The Railway Administration invites tenders for six automobile cars for the 1·68-metre track, and two for the 1-metre track.

France.—July 30th. Supply of high-pressure electrical material for the transformer stations of the railway stations, workshops and warehouses at Rouen and Sotteville. Bureaux du Service Electrique (3e Division), 72, Rue de Rome, Paris.

August 20th. Tenders are invited for the erection of the light and power overhead lines in the stations and workshops at Rennes. Particulars from the Bureaux du Service Electrique (2e Division), Rue de Rome, Paris.

Germany.—July 30th. The Prussian State Railway authorities at Munster, Westphalia, are inviting tenders for four 5-ton electrically-operated travelling cranes.

Greenock.—The Corporation electricity department invites tenders for the supply and delivery of 22,000 tons of steam coal for the year. Mr. J. A. Robertson, burgh electrical engineer.

Heckmondwike.—July 28th. Wiring of new slaughter-house, for the Heckmondwike and District Co-operative Society, Ltd. Mr. H. Stead, architect, Heckmondwike.

Hull.—July 25th. Machinery oils for the Corporation electricity works. Mr. H. Bell, electrical engineer, Sculcoates Lane.

Ilford.—August 11th. Motor tower wagon, for the U.D.C. Tramways Department. Mr. L. E. Harvey, tramways manager.

London.—ROTHERHITHE.—July 31st. Electric light re-wiring and other work at the Infirmary, Lower Road, Rotherhithe, S.E., to the specification of Mr. A. H. Newman, F.R.I.B.A. Forms of tender, &c. (£5 note deposit) from Town Clerk, 283, Tooley Street, London, S.E.

L.C.C.—Tenders are to be invited from selected firms for electric charging apparatus for Waterloo Road fire station, where an electrically-driven motor fire appliance will shortly be placed.

Middleton.—July 28th. Lighting switchboard and renewals to traction switchboard for the Corporation. See "Official Notices" July 18th.

Newport (Mon.).—Re-winding 1,500-KW. three-phase alternator. Mr. A. N. Moore, electrical engineer, Town Hall.

New Zealand.—September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of energy from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Middleton.—July 28th. The Corporation invites tenders for lighting switchboard and renewals to traction switchboard. Mr. S. Pauls, electrical engineer, Townley Street.

Norwich.—August 12th. One 3,000-KW. turbo-alternator and surface condensing plant; rotary converters; E.H.T. switchgear for the Electricity Committee. See "Official Notices" July 18th.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" to-day.

Servia.—BELGRADE.—Supply of 625 telephone instruments of various kinds to the Servian Telephone Department.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

BLOEMFONTEIN.—August 15th. Tenders for supply and equipment of electric tramways (railless) within the city, including poles, brackets, converting machines, switchboard, and 10 railless vehicles. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C. See "Official Notices" to-day.

Shanghai.—August 26th. Two 5,000-KW. steam turbo-alternators, complete with surface-condensing plant: four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" to-day.

Spain.—August 9th. The municipal authorities of Medina del Campo are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

ALDEAMAYOR.—The municipality of Aldeamayor, province of Valladolid, invites tenders for the electric lighting of the city.

Swindon.—July 26th. Steam coal for the electricity works of the Corporation. See "Official Notices" July 11th.

Todmorden.—July 26th. 300-KW. converting plant, H.T. switchboard and cables, mechanical stokers and superheaters, for the B.C. See "Official Notices" July 11th.

Warrington.—August 6th. (1) E.H.T. feeder panel; (2) earthenware conduit for one year, for the Electricity Department. See "Official Notices" July 18th.

CLOSED.

Australia.—According to *Tenders (Mining and Engineering Review)*, the Provincial Electric Development Co., Ltd., of Melbourne, has placed contracts for electric lighting and power equipments for Dandenong and Daylesford (Vic.) in the hands of the I.-R., G.-P. & T. Works Co., Ltd.

The same exchange also reports the following tenders accepted:—

P.M.G., Queensland:—

12,000 copper binders.—I.-R., G.-P. & T. Works Co., Ltd.
12,500 jointing sleeves.—Lawrence & Hanson Electrical Co., Ltd.
74 tons copper wire.—R. Johnson, Clapham & Morris, Ltd.

P.M.G, Western Australia:—

Magneto cordless switchboards.—J. Bartram & Son, Ppty.
10 miles wire, twisted pair.—W. T. Henley's Co.

According to the *Australasian Record*, the following contracts for consumers' meters have been placed:—

Direct current, "Isaria" meters, £824.—Lawrence & Hanson, Ltd.
Alternating current meters, £1,323.—Ferranti, Ltd.

The following orders have been given out for rubber-insulated cable:—

Noyes Bros.	£551
Steffens & Noelle	607
W. T. Henley's, Ltd.	720

The Sydney E.L. Committee has accepted tenders as follows:—

Glazed stoneware bridges.—Bakewell Bros., Ltd.
100 tons bitumen (£695).—W. G. Watson & Co., Ltd.

Argentine.—An order for 15,000 insulator packing pads ("Mascolite," quality P.S.P., ¼ in. thick) has been received by Messrs. Mitchells, Ashworth, Stansfield & Co. Ltd., from the Central Argentine Railway, Ltd. They are to be used under the conductor rail insulators in the electrification of their suburban lines.

Belgium.—Seven concerns—five German, one Belgian and one French—submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of a quantity of telephone cables in the Louvain district, the lowest offer being that of Messrs. Felten & Guilleaume, of Mulheim-am-Ruhr.

Canada.—The Canadian Pacific Railway has awarded the Canadian General Electric Co. the contract for the electrification of the company's line between Castlegar and Rossland. It is intended to use 2,400 volts, direct current trolley system.—*Canadian Engineer.*

Dukinfield.—The installation of electric light at the Technical School and Free Library, and also at the Dukinfield Ward Conservative Club and Old St. George's Church (Stalybridge), is to be carried out by Messrs. C. Benyon & Co., Dukinfield.

Ealing.—The B.C., on the recommendation of the Electricity Committee, has accepted the following tenders for supplies during the ensuing year:—

E. Foster & Co.—500 tons of Bwllfa large coal, and 2,000 tons of Walsall Wood washed nuts.
J. Edge & Co.—3,000 tons of Bwllfa washed nuts.
Young Bros.—Pipes, bends, &c.
Duckham & Co.—Cylinder oil.
Atlas Lubricating Oil Co.—Crank chamber oil and bearing oil.
Bruce, Wallace & Co.—Paraffin.
Nicol & Co.—Waste.

The figures were not disclosed, but Alderman H. W. Peal, J.P., chairman of the Committee, said that the lowest tenders had been accepted in all cases except one, in which instance it was thought undesirable.

East Ham.—The tender of Callender's Cable and Construction Co., Ltd., has been accepted by the T.C., at £55 10s., for a new feeder pillar.

Fleetwood.—The U.D.C. has accepted the tender of Messrs. Thomas Riley, Ltd., for extensions to the boiler house at the electricity works.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

WAR OFFICE.

Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; Johnson & Phillips, Ltd.
Electric lamps.—Crypselco, Ltd.
Signalling lamps.—Siemens Bros. & Co., Ltd.
Installation of electric lighting, &c., R.M. College, Sandhurst.—V. G. Middleton.

INDIA OFFICE: STORE DEPARTMENT.

Accumulators.—Pritchetts & Gold; J. Stone & Co.
Cells.—Pritchetts & Gold.
Insulators.—Bullers, Ltd.

CROWN AGENTS FOR THE COLONIES.

Insulators.—Bullers, Ltd.; Siemens Bros. & Co., Ltd.
Relays, &c.—I.R., G.P. and Telegraph Works Co., Ltd.
Switchboard.—Siemens Bros. & Co., Ltd.
Insulated wire.—Hooper's Telegraph and India-Rubber Works, Ltd.

POST OFFICE.

Telephone exchange equipment and testing positions, Central and City Exchanges, London.—Western Electric Co.
Telephone exchange equipment:—
Doncaster and Runcorn.—Peel-Conner Telephone Works, Ltd.
Central Exchange, Edinburgh; Ealing; North Exchange, London; and Shipley.—Western Electric Co., Ltd.
Museum Exchange, London.—Automatic Telephone Manufacturing Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Wood arms.—A. Bailey; British Australian Timber Co., Ltd.; Millar's Timber and Trading Co., Ltd.
Submarine cable.—W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—B.I. and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Telephonic ironwork.—Walls, Ltd.
Telegraphic ironwork.—Bullers, Ltd.; T. W. Lench, Ltd.
Telegraph paper.—Brown & Murray, Ltd.; Waterlow & Sons, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.

Huddersfield.—The Electricity Committee has accepted the following tenders:—

J. Proctor, Ltd.—Coal elevator.
J. Moody, Son & Co.—Hydraulic hoist.

London.—L.C.C.—The Highways Committee received the following tenders for a 50-ton overhead travelling crane for Greenwich generating station, in connection with the first stage of the work of substituting turbines for reciprocating plant:—

Babcock & Wilcox, Ltd. (accepted)	£2,285
Cowans, Sheldon & Co., Ltd.	2,809
Joseph Booth & Bros., Ltd.	2,970
Carrick & Ritchie, Ltd.	2,989
S. H. Heywood & Co., Ltd.	3,592

Chief officer's estimate, £2,200.

The tenders submitted for charging apparatus for the new Hammersmith fire station were:—

Electric Construction Co., Ltd. (accepted)	£158
General Electric Co., Ltd.	181

STEPNEY.—The following tenders have been received by the B.C. for carrying out alterations to the electric light installation at the Whitechapel Library:—

Sweet Bros. (accepted)	£65
Barlow Bros.	73
Ward Bros.	76
G. Weston & Sons, Ltd.	85
Smeeton & Page	86

For the provision of converting plant the following tenders have also been received:—

	R.P.M.	Price.
Siemens Bros. Dynamo Works, Ltd. (rotary)	750	£4,245
British Westinghouse Co., Ltd. (rotary)	500	4,445*
British Thomson-Houston Co., Ltd. (rotary)	500	4,540
General Electric Co., Ltd. (rotary)	500	4,719
" " " "	375	5,227
" " " "	300	5,794
A.E.G. Electric Co., Ltd. (rotary)	500	5,100
" " " (motor generator)	500	5,400
" " " "	300	7,000
Bruce Peebles & Co., Ltd. (motor converter) (accepted)	375	5,280†
Electric Construction Co., Ltd. (motor generator)	300	6,178
Brown, Boveri & Co. (rotary)	750	4,898
" " "	500	6,770
Dick, Kerr & Co., Ltd. (motor generator)	428	6,840

* Without booster; £5,207, with booster. † Without spares.

The tender of Messrs. F. W. Brackett & Co., Ltd., has been accepted, at £720, for the supply of a patent screening apparatus at the electricity works; also that of Messrs. Drew-Bear, Perks & Co., Ltd., at £29,314, for extending the Limehouse generating station. Seven other tenders were received, ranging from £31,831 to £41,633.

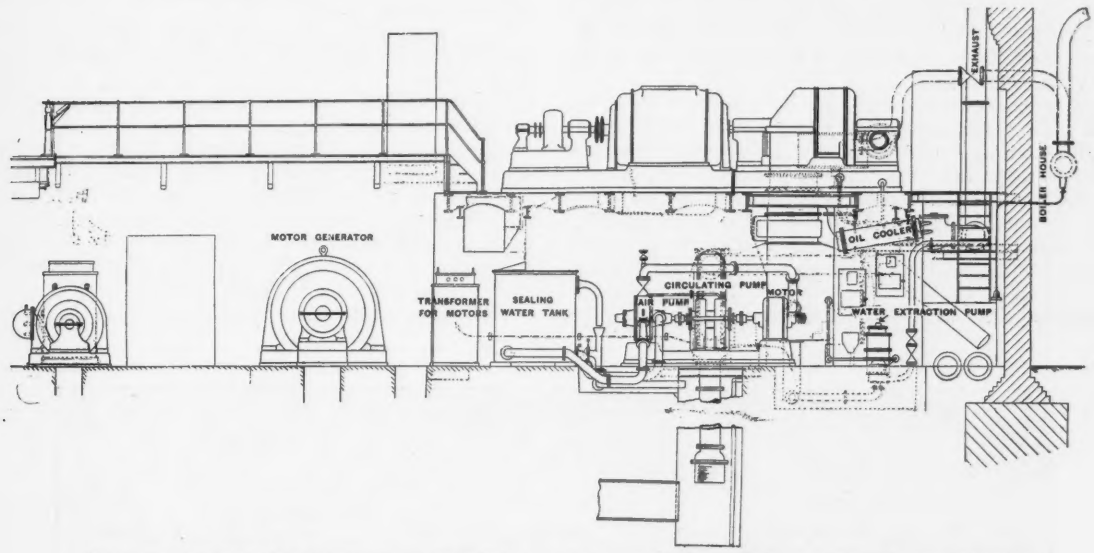
(*Continued on page* 143.)

ELECTRICITY EXTENSIONS AT BURTON-UPON-TRENT.

The Corporation electrical undertaking at Burton-upon-Trent was originally started in 1894, the earliest plant consisting of 80-kw. rope-driven alternators, with open-type engines and Lancashire boilers. The 19 years' interval between then and now has seen the introduction of the high-speed engine and its practical supersession by the steam turbine which has been adopted in the recently completed extensions.

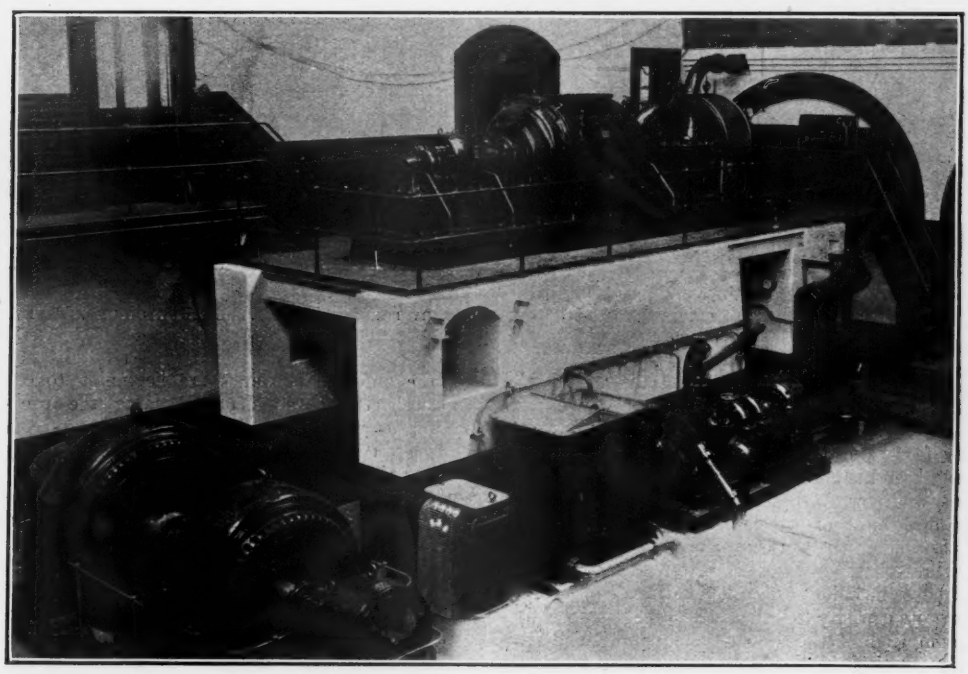
The original system of supply for lighting and power was a 75-cycle, 2,000-volt, single-phase alternating one, transformed down to 100 and 200 volts for consumer's use, and this has continued up to the present time, Burton being one of the very few places in this country where single-phase motors have been largely adopted for industrial driving. During the lengthy interval mentioned above the Corporation tramway undertaking was inaugurated, and for supplying the traction load, 500-volt direct-current generating plant was necessarily added to the installation.

Towards the end of 1911, when it became evident that additional generating plant would have to be installed, the opportunity was taken to reconsider the whole question of system of supply, and on the advice of the engineer, with a view to more adequately meeting the industrial power load of the town, it was ultimately decided to adopt a three-phase system of supply.



Drawing Showing Arrangement of New Turbine Set and Condensing Plant, Burton-upon-Trent.

A scheme on these lines was prepared by Mr. Thos. Hall, the borough electrical engineer, and eventually adopted; it included the provision of turbo-generating plant, and the installation of a motor-generator link with the existing single-phase supply, and a rotary-converter to link up the tramway direct-current supply with the new three-phase generating plant; new boilers, economisers, switchgear, workshops and three-phase mains were also included in the scheme, borrowing powers for which were sanctioned by the L.G.B. in June, 1912.



General View of Turbo-Alternator, Motor-Generator, and Condenser Auxiliaries

Having in mind past experience, the whole of the plant

has been raised two to three feet above flood level; the turbo-alternator has been erected upon pillar foundations, as shown in our view, and provision has been made for putting in a duplicate turbine alongside. This machine is of the Westinghouse-Rateau type, with a normal rating of 1,250 KW.; the generator is totally enclosed, being ventilated by means of a fan at each end of the rotor—the fans drawing clean air through ducts from an air filter, and discharging it through the machine in an axial direction, and into the engine room. The exciter is mounted on an extension of the bedplate, and is shunt wound and fitted with radial commutators.

The turbine exhausts into a surface condenser of 1,980 sq. ft. cooling surface immediately underneath, and this plant is provided with a circulating and Leblanc air-extraction pump set, coupled to a 40-H.P. three-phase motor running at 960 R.P.M. A vertical-spindle 6-H.P. water extraction pump is also provided for returning the condensate to the hot well.

An additional Babcock boiler of 10,000 lb. per hour evaporative capacity, fitted with an Underfeed stoker, has been installed in the boiler house, where previously Lancashire boilers have been used, and in connection with this plant, a new 600-tube Green economiser, and the additional flues, &c., leading to a new chimney have been provided.

The boiler feed plant has also been rearranged, two Weir pumps having been installed in the economiser house, also a water softener and new overhead tank, together with certain auxiliary pumps, most of which plant formerly occupied unsuitable positions in the works.

The new three-phase single-phase motor-generator, which is a Westinghouse machine of 500-KW. rating, is also shown in our views; its capacity is sufficient to cope with the present maximum load of the single-phase supply, and it is available for running in the reverse direction to supply three-phase current if required. The machine is started up by a D.C. motor. The rotary converter, also supplied by the Westinghouse Co., is rated at 300 KW., and is capable of carrying the maximum tramway load; it also is reversible, and can be utilised if desired to supply three-phase current when driven from the existing direct-current tramway generating sets.

This arrangement of plant obviates the necessity of running four or five steam-driven sets, as the new turbine will at present cope with the whole demand of the station through the machines above mentioned.

A five-panel Westinghouse switchboard for controlling the new plant has been provided, and is shown in one of our views. The switch cubicles are under the operating gallery on the ground floor, adjoining the present single-phase and direct-current (traction) switchboards.

It is, however, hoped in the future to remove all this switchgear to the gallery.

The laying of three-phase mains has already been commenced, and several large consumers have been connected. It is intended that a trunk ring main shall be installed through the town; a portion of this work has been carried out and the remainder sanctioned.

The staple industry of Burton-upon-Trent is of world-wide reputation, there being no less than 17 different breweries situated within the borough. The bulk of the other industries in the town are connected with the brewing trade, and it is satisfactory to note that up to the present time there is something like 1,800 H.P. of motors connected to the original single-phase system of supply.

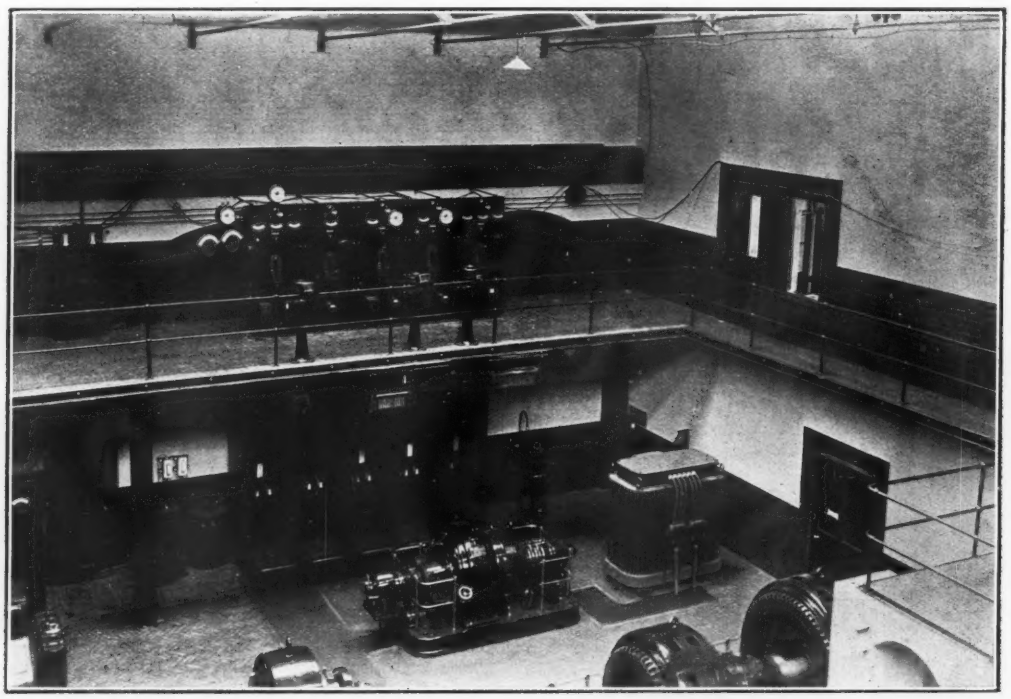
Now that the three-phase system is available, the directors of the different breweries are beginning to consider more seriously the question of extending the use of electric power, as with the new system the motors can be coupled direct to the work instead of through loose pulleys as in the case of the single-phase supply.

Already one of the leading brewers, Messrs. Marston, Thompson & Evershed, Ltd., have decided to take a supply from the Corporation mains for the complete electrification of their brewery.

Another very large consumer is Messrs. Bass, Ratcliff and Gretton, Ltd., who are taking power principally for refrigerating purposes, and it is interesting to note that they are gradually extending it over the whole of their extensive brewery, more especially for the isolated pumping and refrigerating plants.

Other breweries are now realising the adaptability of the three-phase supply, and are commencing by driving their malt mills, which are always situated at the top of the brewery, so that there is every possibility of them extending until the whole brewery is electrically driven.

The local Commercial Development Committee has for some time past been advertising the unique position of Burton-



NEW H.T. SWITCHBOARD, CUBICLES, &C., AND 300-KW. ROTARY FOR TRACTION SUPPLY, BURTON-UPON-TRENT.

upon-Trent as an industrial centre, and there is no doubt that the step taken by the Electricity Committee in changing over to the three-phase supply should be of great assistance in securing new industries.

In conclusion, we are indebted to Mr. Hall, the borough electrical engineer, for his assistance in connection with this short article.

A MODEL GAS-ENGINE PLANT IN JAPAN.

The Kawasaki Dockyard Co., one of the two largest and most enterprising shipbuilding companies in Japan, have for a long time adopted electrical methods, direct-current 220-volt motors being used throughout for driving the various machines and tools.

Recently, owing to considerable extensions which have been made to the works, and a consequent increase in the demand for power, it was decided to scrap the existing obsolete generating plant, and replace it with something more up to date, and as a result of careful investigation by the engineers, both in Japan and abroad, it was decided to install a 500-kw. generator, direct-coupled to a four-cylinder scavenger-type producer gas engine, together with the necessary gas plant.

Tenders were therefore called for from the local representatives of the various makers of gas engines, both English and Continental, and eventually the contract was placed with Messrs. L. J. Healing & Co., Ltd., one of the oldest and best-known firms in Japan.

The plant is now working, and the results have exceeded expectations. Japanese coal is notoriously poor in quality, but notwithstanding this feature, the consumption is well under 2 lb. per kw.-hour, being about half the consumption of steam turbines installed in another power station of the company.

The gas-producing plant is of the Mond non-recovery type, and was manufactured by the Power-Gas Corporation, Ltd. Fig. 1 gives a general idea of the arrangement of this plant. The coal is conveyed to the top of the producer by means of a simple motor-driven elevator. The body of the producer itself is of the ordinary cylindrical type and stands in a water lute, which also acts as a seal. The producer is fitted with a grate in the shape of an inverted truncated cone, the truncated part consisting simply of an opening through which the ash can easily fall when the attendant wishes to remove it through the water-lute. Air and steam under slight pressure are admitted under the grate, the steam being produced either in a separate boiler, as shown in the diagram, or preferably by an exhaust gas-fired boiler, as in the installation under review. About 2 lb. of steam per B.H.P.-hour output of the engine is required by the producer, and it is found in practice that an exhaust boiler will supply this quantity of steam.

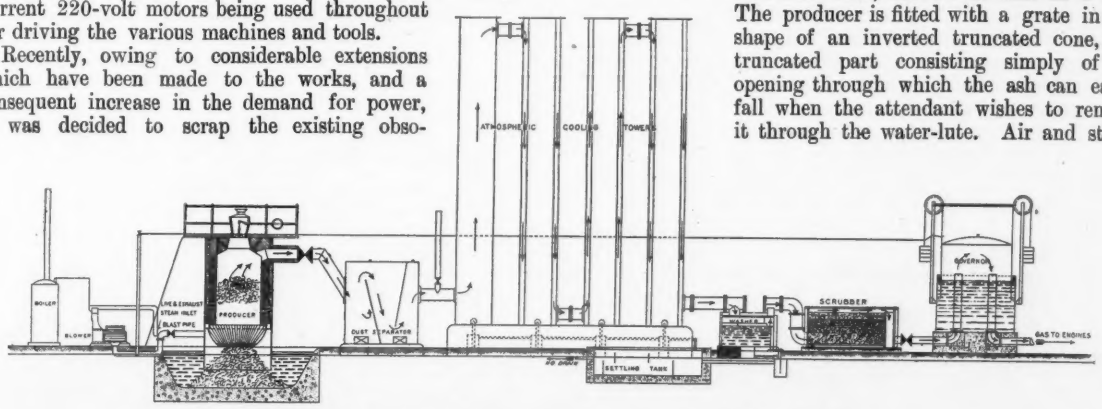


Fig. 1.—Diagram Showing Arrangement of Mond Gas Plant.

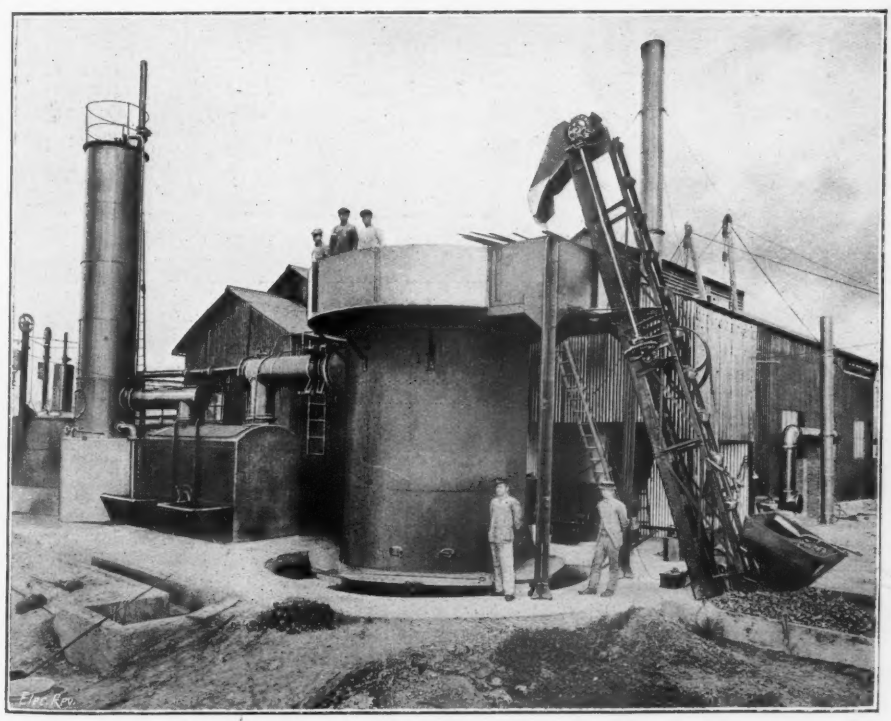


Fig. 2.—Mond Gas Plant Installed at the Kawasaki Dockyard, Japan.

The gas from the producer first passes through a regenerator (not shown in the drawing), where part of its heat is given up to the incoming air. After this it passes through a dust separator, a tar extractor, cooling towers, a washer, and duplicate scrubbers, to a gas holder, which at the same time acts as a governor, and thence the gas is drawn on to the engine. It should be mentioned that the temperature in Japan in summer is very high, therefore great pains have to be taken to ensure the efficient cooling of the gas, otherwise tar would be carried through to the engine, and damage to the valves would result.

Two water-cooling towers have been erected, one of which is used for cooling the gas engine circulating water, and the other is used for cooling the water which is used in cleaning the gas. This latter water eventually becomes strongly ammoniacal, and is sold to the local gas company to be treated in their sulphate of ammonia recovery plant.

As a by-product a certain amount of tar is produced, and

as the heat value of tar per unit of weight is several times that of coal, the former is burnt under the steam boilers in another part of the works, and results in a corresponding saving in coal.

Fig. 2 shows the appearance of the gas plant in course of erection.

The gas engine itself is of the single-acting multi-cylinder scavenger type having four cylinders and four cranks, the latter being set at 180°, so that there is one explosion and one impulse every half-revolution. The engine was manufactured by the Premier Gas Engine Co., of Sandiacre; its rated load is 900 B.H.P. at a speed of 200 R.P.M. It was arranged to install a unit of this size in order to enable it to take care of the overload of the dynamo.

The scavenging arrangements deserve special comment. In this engine they consist of an air-pump mounted above the engine cylinders and actuated from the connecting rod. This pump stores air in a receiver at a pressure of a few pounds per square inch only. When the exhaust valve is opened, the scavenging air-admission valve is also opened, with the result that there is a thorough scour through the cylinder. A two-fold advantage is obtained by this: The cylinder and piston surfaces are kept within moderate limits of temperature, thus facilitating lubrication and reducing wear; and at the same time the burnt gases are completely swept from the cylinder, resulting in a purer explosive mixture and consequent increased output for a given size of cylinder.

The engine exhausts through a special boiler which is a modification of the locomotive type. Its function is to extract as much heat as possible from the exhaust. In practice it is found that about 2 lb. of water can be evaporated to steam at 70 lb. pressure for every B.H.P.-hour output of the engine. With a large engine, the quantity of steam obtained is an important item and is more than enough to drive the auxiliary machinery required by the plant and to provide the necessary steam for the gas plant.

The dynamo is a Bruce Peebles standard slow-speed compound-wound machine fitted with inter-poles. Its rated output is 2,225 amperes at 225 volts continuously, with a further overload of 25 per cent. for two hours. The general appearance of dynamo and engine is shown in fig. 3.

The switchboard was manufactured by Messrs. Ferranti, Ltd., and consists of white marble panels fitted with the necessary instruments and switchgear.

The installation was carried out by Japanese workmen under the supervision of the Kawasaki Co.'s engineers, and both the latter company and Messrs. Healings are to be congratulated on the result.

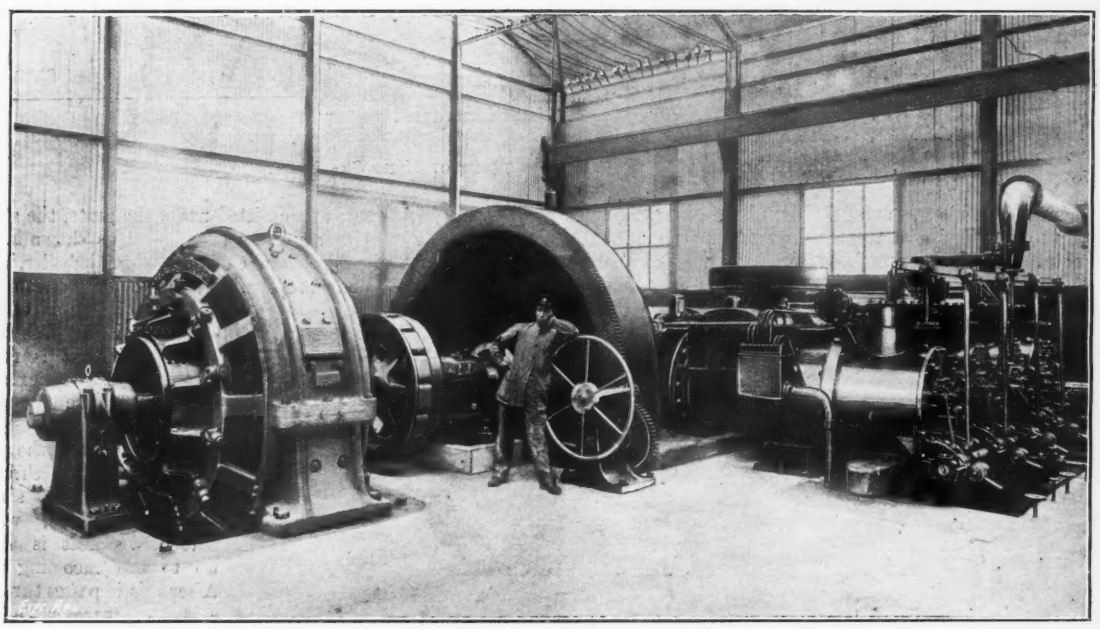


FIG. 3.—GAS-ENGINE-DRIVEN GENERATING SET, KAWASAKI DOCKYARD, JAPAN.

THE GOODS CLEARING-HOUSE SYSTEM.

LAST week the New Transport Co., Ltd., gave a demonstration of the system of sorting goods originated by Mr. A. W. Gattie, carried out with machinery invented by him and Mr. A. G. Seaman, and further developed by the engineering staff of the company. Mr. Gattie for some years has assiduously urged the imperative necessity of reform in the methods used for handling and sorting freight at railway terminals and goods yards, pointing out the excessive waste of labour and time incurred under the existing conditions, and the company which has been formed to carry out his ideas proposes to establish a huge goods clearing-house for the railways serving the metropolis, in place of the 74 goods stations which at present exist in London.

The Clearing House would have eight floors, and would provide for the unloading of all goods trains, the dispatch of the goods to the consignees, the receipt of goods outward bound, and the loading of goods trains—all these operations being carried out on an organised system, which reduces to the minimum the handling of goods, the congestion of the platforms and roadways, and the time occupied in transit. The scheme provides for the arrival and dispatch of 240 trains per day, and of 5,000 motor delivery and collecting wagons, each making seven trips a day. The Clearing House would be situated in Clerkenwell, on a site of 30 acres, and would be approached by 10 tube railways. Below street level would run 24 railway berths, from end to end of the Clearing House, each long enough to accommodate a 70-wagon goods train. Over these, on the street level, 12 road bridges would cross at intervals from side to side of the Clearing House. A road vehicle could thus be brought over any desired rail vehicle, and a load could be transferred from the one to the other by an electric overhead crane. Below the rail level would be a "crypt," in which whole wagon loads could be sorted, and, if necessary, temporarily stored until a train was ready to receive them. Above the road-bridge level would be four sorting floors, and above these an eighth floor, with offices and repair shops. In order to save time in loading and unloading, a whole wagon-load would be dealt with at one lift by a crane, by using a "container"—in effect, a removable body which could travel equally well by road or rail. Instead of the 100,000 vehicles which at present block the streets, 5,000 would suffice, and as they would make periodical calls at warehouses, &c., throughout the day, there would be no need for them to stand long anywhere—the most fruitful source of congestion. The machinery employed for sorting the goods is most ingenious; the parcels are placed in trays, which are carried automatically by continually running conveyors to the appropriate places for loading, the trays sliding smoothly from one conveyor to another as required until they reach their destination. It is impossible to describe the methods employed in the space here available, but as the whole of the apparatus would be electrically-driven, consuming 40 million units a year, and the capital outlay on the electric locomotives alone would be £100,000—the total outlay contemplated being 14 millions sterling—it is clear that the adoption of the scheme would be of the first importance to the electrical industry, while, if successful, it would confer immense benefits upon the metropolis. The system is also suitable for other cities and for large stores, &c.

CONTRACTS CLOSED.

(*Concluded from page* 138.)

Keighley.—The Corporation Tramways Committee has accepted the tender of the Cedes Electric Traction Co., Ltd., for a spare pair of hind wheels, with armatures complete, and a spare current collector and flexible wire to the disconnecting socket, for the trackless trolley vehicles, at £123 10s.

Long Ashton.—The Guardians have accepted the quotation of the Portishead Electrical Supply Co. to wire the Portishead Cottage Homes.

New Zealand.—The Dunedin Municipal Council has placed the following contracts:—

Turnbull & Jones.—16 and 22-K.V.A. constant current transformers, lightning arresters, A.C. regulators, S.P. transformers, &c.
Lawrence & Hanson Electrical Co.—Time switches.
National Electrical and Engineering Co.—5 and 10 K.V.A., also ½ to 50 and 150 to 200 K.V.A. transformers.

Nuneaton.—The Electricity Committee of the T.C. has accepted the tender of the Phœnix Dynamo Manufacturing Co. for a line booster, at £321.

Ramsbottom.—The Education Committee has accepted the tender of Mr. Thomas Cornall, of Bury, for the installation of electric light at St. Paul's Church of England School.

Rotherham.—The tender of Mr. Chas. Willis has been accepted by the T.C., at £96, for an electric hoist.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd, for tramway points and crossings, at £295; and that of Messrs. Willans & Robinson, Ltd., for a new engine crankshaft, at £75

Messrs. E. Bennis & Co., Ltd., have received an order for their coal-handling plant, consisting of bucket elevator, chain conveyor, coal-storage bunkers, &c., for the Corporation electrical undertaking.

Torquay.—Messrs. Drury & Chaffe have secured the tender for the electrical illumination of the exterior of the Pavilion and the portion of the Princess Gardens contiguous thereto, at a cost of £260.

Transformer Contracts.—Messrs. Johnson & Phillips, Ltd., of Charlton, have secured the following orders for their standard type oil-cooled transformers during the last few weeks:—

Two 625-K.V.A, 6,600 V., for Dundee Corporation.
Two 150-K.V.A., 6,000 V., for Wigan Corporation.
One 500-K.V.A., 6,600 V., for Oldham Corporation.
Three 100-K.V.A., 2,000 V., for the Admiralty.
Fifty-one 50-K.V.A. and three 300-K.V.A., 13,200 V., for Canada.
Four 400 K.V.A., 10,000 V., for Japan.
Two 350-K.V.A., 6,000 V., for Brazil.

In addition, they have secured contracts for upwards of 5,000 K.V.A. in transformers for English machinery makers in connection with converting plants, &c.

Walthamstow.—The U.D.C. has accepted the tender of the Blaeberg Engineering Co., Ltd., at £980, for the erection of a natural-draught cooling tower at the generating station. The tender of Messrs. A. Blackmore & Co. has also been accepted for a supply of coal to the electricity department as follows:—5,500 tons double-screened peas, 14s. 8d. per ton; 5,000 tons Gedling peas, at 14s. 7d.; and Granville nutty slack, at 14s. per ton.

Yarmouth.—The tender of Messrs. C. & J. Webb & Co., Ltd., has been accepted by the T.C. for a supply of overcoats to the tramways department as follows:—For motormen, £1 4s. 10d. per coat; for conductors, £1 3s. 7d.; for inspectors, £1 16s. 9d.; for chief inspector, £1 18s. 3d.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Tuesday and Wednesday, July 29th and 30th. At 10 a.m. At the Senate House of the University. Papers on "A New Method of Cooling Gas Engines," by Prof. Bertram Hopkinson; "Modern Methods of Measuring Temperature," by R. S. Whipple; "Modern Pumping Machinery for the Drainage of the Fens," by R. W. Allen; "A Few Notes on Engineering Research and its Co-ordination," by G. H. Roberts.

Imperial Motor Transport Conference.—Friday, July 25th. At Olympia, London. Conference closes.

Memorial to Sir William White.—There is a movement on foot to establish a memorial to the late Sir W. H. White. The *Times* states that the principal engineering institutions are interested in the matter, and promises of financial support and other communications regarding the matter should be addressed to the secretary of the Institution of Naval Architects (Mr. R. W. Dana), 5, Adelphi Terrace, W.C.

NOTES.

British Trade with Canada.—With reference to our recent articles on the above subject, we have received the following communication from Mr. Percy Joyce, of 205, Bolton Road, Walkden, Manchester:—

"I notice a statement in the leading article of the current issue of the ELECTRICAL REVIEW 'British Trade with Canada' (and which coincides with our advertisement in the agencies' column, on page 18 of the same number) that a very large number of engineers in Canada are either of American nationality or have been trained on American soil, a fact which naturally influences business in favour of United States firms." There is a considerable amount of truth in the statement, but I know from practical experience that at least one-third of the business could at any time be easily secured by British firms without any, or at least very little, competition, if British firms were alive and conversant with the Canadian methods.

"It is gratifying to know that British goods are continually being asked for, and British engineers are preferred, but they cannot be obtained, as they are all stuck in Britain, afraid of the American underwriters. Canadians have no particular love for Yankees anytime, but there are no Canadian engineers, so that the business must go to the first comer. Mr. Hamilton Wickes can produce very interesting reports on Canadian trade, as he did with the Australian trade, but before waiting for further reports, may I be allowed to state here briefly to those firms interested that the greatest drawback to British firms securing business with Canada, is bad representation, a want of agents on the spot who are good engineers.

"I make this suggestion because much of the work is done for building contractors, hotel and business proprietors, farmers, &c., and other people who have little or no technical knowledge of engineering matters, but who are always keen on obtaining the best advice, and seeking the simplest and clearest explanations. It is because I know this that we are asking to be allowed to represent some British firms there. The ELECTRICAL REVIEW has always left its columns open to Canadian matters; it has repeatedly described to firms on this side of the Atlantic what was required to gain a fair footing in Canada, but what has resulted? Nothing. It cannot be emphasised too strongly the necessity of being well represented in that territory, therefore, in the interests of British manufacturing firms, we shall be pleased to give any information we can, before returning, between now and August 30th. I do not advise firms to proceed to send agents out there who have not had some previous Canadian experience, that would be just as futile.

"It may be of interest to readers to know that some few years ago five small British firms of good standing agreed mutually to speculate a few hundred pounds on opening branches and showrooms and establishing agencies in Montreal, Quebec and Ontario, with a view to securing a portion of the Canadian trade. This proved successful, and judging from the amount of trade they are doing now, I think they have been amply repaid, and it would be wise if other firms would work on the same principle."

The B.A. Meeting.—In its issue of Monday last, the *Times* publishes its usual forecast of the forthcoming meeting of the British Association meeting at Birmingham. It is expected that there will be a large attendance—over 3,000. Among the subjects down for treatment before the Mathematical and Physical Science Section is a paper on "Lightning and Protection Therefrom," by Sir J. Larmor. In the Chemistry Section there will be a discussion on the economical use of fuel. In Section G (Engineering), the sectional president (Prof. Gisbert Kapp) is to deal with the electrification of main line railways; Prof. Marchant is down for a paper on "Some Effects of Atmospheric Conditions on Wireless Signals"; Prof. Howe for one on the "Electromagnetic Rays Employed in Radio-Telegraphy, and the Mode of their Propagation"; Prof. F. W. Lancaster will discuss "The Internal Combustion Engine as Applied to Railway Locomotives"; and Prof. Burstall, "Solid, Liquid and Gaseous Fuel."

The Commercial Motor Vehicle Exhibition at Olympia.—From an electrical point of view, this exhibition is disappointing. No attempt whatever has been made to bring the battery-driven vehicle before the public, either for light or heavy commercial work. Our representative was surprised to find that even the Edison battery people were not there. Four 40-H.P. Tilling-Stevens vehicles are shown by Messrs. W. A. Stevens, Ltd. Great interest appears to be aroused by these cars, and the stand attendants are kept busy. Various improvements have been made in the general design. The makers have found it desirable to mount the electric motor on a sub-frame, so that its centre line lies some inches below the centre line of the engine and dynamo, thus lowering the c.g. of the whole vehicle. On the 40-H.P. type the radiator is placed in front of the engine, and the control boxes are mounted on the dash-board inside the bonnet, instead of being right at the knees of the driver, as in the 30-H.P. type. The leaf spring coupling between the engine and the dynamo has been superseded by a leather ring coupling.

Nine firms are exhibiting dynamo lighting sets, most of which we described at the time of the last International Motor-Car Exhibition. Several well-known makers of electric ignition apparatus have evidently deemed it not worth their while to be present, representation in this section being not very strong.

An electrical change-speed gear is exhibited by the firm of G. A. Claus; Messrs. W. Canning & Co. show electroplating plant; and the E. O. and A. Co. show a selection of "Timken" roller bearings.

The Swansea Strike.—Regarding the strike at Swansea Corporation electricity works, to which we made brief reference recently, our correspondent writes:—"Matters industrially have not been running at all smoothly at the Swansea Corporation electricity station, and the climax was reached by the unskilled workmen to the number of 41, who belong to the Dockers' Union, ceasing work on only 24 hours' notice. The men complained that the system of promotions had not been fairly carried out, but the immediate cause of the stoppage was the dismissal of a fitter's labourer named Wm. Morris on account of slackness of work and the retention of another workman with a shorter period of service to his credit. The general body of workmen adopted a high-handed attitude in ceasing work without the usual week's notice, which would have given the electrical engineer (Mr. C. A. L. Prussman) and his Committee, of which a practical electrician in Ald. A. Sinclair is chairman, an opportunity of arranging an amicable settlement, but even this was eclipsed by the demand made by the Dockers' Union, on behalf of the men, that Morris should be reinstated and the other man stopped. The Council in Committee, realising the gravity of the step taken by the men, at once met to consider the matter and, in the end, a special Committee was appointed to deal with the dispute, one of the conditions being that the Committee should discuss the principle of promotion or retention by seniority, other things being equal. The Committee accepted this principle, and also decided that the engineer should draw up a classification scheme with a view to Morris's case being considered. There was some difficulty at the outset over this, as it was not clear whether the classification should combine inside and outside men, or whether there should be a separate classification for each. This matter was left with the engineer, who is now engaged in preparing the scheme. The strikers, after a day's stoppage, during which the station was kept going by the ordinary staff, returned to work, and it is anticipated that when the classification is arranged, Morris will be reinstated on the ground that he is senior in point of service. Meantime, by arrangement, he is on the funds of the Dockers' Union. Whilst this dispute is in the balance, the Amalgamated Society of Engineers has taken up the wages case of two of its members at the station. The Committee had already made an advance, but the Society wanted the Swansea rate of 45s. per week, or 2s. per week more than the Committee had conceded, notwithstanding that at the docks where the 45s. rate prevails, holidays are not paid for, as is the case at the electricity station. A compromise has been effected, the Committee offering a further 1s. advance, making 44s. per week and payment for holidays. The outcome of the whole matter is likely to be the formation of a Conciliation Committee to deal with disputes of the kind, it being felt that it is a serious thing for the community to be at the mercy of this 'down tools' policy at any moment the men choose to put it into operation."

Later information shows that the dispute is still in the balance. The borough electrical engineer, Mr. Prussman, acting under the instructions of the special committee appointed to deal with the causes of the recent strike at the works, has prepared a classification scheme under the seniority principle accepted by the committee. In effect, this reinstates the workman who had been dismissed because of slackness of work, and a man named Henry, being the junior hand, is to go instead. Both are members of the Dockers' Union, who claim that a workman named Scobell, a member of the Railwaymen's Union, is the one to be dismissed. Another "down tools" is threatened, but before anything is done in this direction, the whole matter is to be laid before the Executive Committee of the Dockers' Union, in London.

Copper. — From the statistics furnished by Messrs. Merton's circular, it appears that the demand for copper during the first half of July has been fairly brisk. Visible supplies, if taken for England and France and afloat thereto from Chile and Australia, show an increase of 1,186 tons, distributed over stocks at Havre, and quantities afloat. English stocks lost 558 tons. Visible supplies for the whole of Europe show a drop of 923 tons for the fortnight, consisting almost entirely of withdrawals from Hamburg, which shows a drop of 1,607 tons out of the 2,109 tons, making up the difference between an increase of 1,186 and a decrease of 923.

In supplies, North America is above average, Spain and Portugal low; Chile shipments are heavy, and Australian also well above the average. Deliveries, at 26,456 tons will, if maintained, show a fairly high figure at the end of the month.

The American Producers' Association give American stocks for the end of June at 23,578 tons, a decrease of 6,544 tons during June. The world's visible supply shows a decrease for June of 8,535 tons, and stands at 61,774 (for end of June), or half what it was in November, 1911.

International Time Signals.—Finding that the time signals issued from Paris and Norddeich since July 1st were not in conformity either with the new or the old scheme, but appeared to be a combination of both, Mr. F. Hope-Jones wrote to Commandant Ferrié, of the Eiffel Tower station, for an authoritative statement on the subject. The following is a translation of part of a letter just received from him, which Mr. Hope-Jones has kindly sent us:—"I have the honour to inform you that the new International Signals established by la Conference de l'Heure in October last, and which were to have been employed commencing from July 1st, could not be inaugurated at the date fixed, for the following reason: The German technical services have announced that certain material difficulties would prevent the time station of Norddeich from being ready before the month of October at the earliest. As the station of Norddeich now sends the time at midnight, and as, according to the new conventions, the Eiffel Tower ought also to send the time at midnight, there would result a jamming of the two emissions. So we have had to delay putting into operation the decisions of the Conference. Nevertheless, we send the new automatic time signals at 10 a.m., according to the new Conventions, in order to give practice to people who take the time. We continue, however, to send the time as formerly at 10.45 a.m. and 11.45 p.m. with the old signals. We were ready to operate on July 1st, as is shown by the fact that we commenced the new morning signals on that date, but it is by courtesy that we have delayed putting into practice the whole of the new international arrangements."

Parliamentary.—VARIOUS BILLS.—In the House of Lords on July 16th, the Western Valleys (Monmouthshire) Railless Electric Traction Bill and the Dover Harbour Bill were read a second time, and the Rhondda Tramways (Railless Traction) Bill was read a third time and passed.

In the House of Lords on Tuesday, the London County Council (Tramways and Improvements) Bill was read a second time.

In the House of Commons on 15th inst., the Metropolitan District Railway Bill was read a third time.

Electricity Supply Rifle League. — Representatives from the clubs forming the above league had a friendly shoot on Saturday afternoon last with a similar selection from the North-West Middlesex Rifle League. The match took place on the well-equipped range of the Alperton and Wembley Rifle Club, and the North-West Middlesex League won by 25 points. The teams were 14 aside and 12 to count, and the distance was 25 yards. Appended are the scores:—

North-West Middlesex League.—C. W. Barker (Alperton and Wembley), 98; —. Iggulden (Ruislip), 98; W. J. Busby (Alperton and Wembley), 97; H. Gibbons (Hendon), 97; E. F. Moore (Harrow), 97; A. W. Chinn (Alperton and Wembley), 96; C. J. Chinn (Linacre), 95; C. S. Ingram (Harrow), 95; P. J. Gobby (Hendon), 94; W. E. H. Calcoff (Harrow), 94; R. Abercrombie (Ruislip), 93; C. N. Sims (Alperton and Wembley), 93. Total, 1,147. G. Hart (Linacre), 88; J. Gerrard (Neasden), 88. *Electricity Supply League.*—W. J. D. Partridge (Westminster), 97; S. G. Rhodes (Central), 97; A. Brackley (Central), 97; E. Neville (Westminster), 94; H. A. Pearman (Westminster), 94; F. A. Brown (Ilford), 93; R. Tufnell (Ilford), 93; L. Tufnell (Ilford), 92; G. Horley (Westminster), 92; A. E. Beale (Brompton), 91; E. G. Furneaux (Brompton), 91; F. Winchcombe (Westminster), 91. Total, 1,122. H. Mugford (Brompton), 90; A. H. Harvey (Central), 88.

Light refreshments were kindly provided by the lady friends of the Alperton and Wembley Club who had kindly placed their range at the disposal of the leagues for the match, which was thoroughly enjoyed by all concerned. Later in the afternoon an impromptu billiard match was arranged at the Chequers' Inn amongst the members of the Electricity team, and resulted in a win for their captain, Mr. Partridge, of Westminster.

The Microtropometer.—An extremely clever device has been suggested by Mr. G. A. Shakespear, of Birmingham University, in a letter to *Nature*. He proposes to place two instruments physically in series, using the second as a delicate detector and powerful magnifier of the indications of the first. Thus, he adjusts two Boys radio-micrometers in such a way that the luminous image reflected from the mirror of the first is received upon the vane of the second, causing the mirror of the latter to give a scale deflection of 1,000 mm. If, now, the image received by the vane is 1 mm. wide, it is evident that by a movement of 1 mm. it can be brought entirely on or off the vane; thus the movement of the first image causes the second image to be displaced 1,000 times as much, and if the first moves only 0·001 mm., the second gives the readable deflection of 1 mm., the combination resulting in an extraordinary increase of sensitiveness. Mr. Shakespear has tried the method with very satisfactory results, and points out that the first instrument may be any instrument in which a beam of light is used as an indicator, such as a galvanometer, electrometer, or a string-galvanometer, while instead of the radio-micrometer for the second instrument, a thermo-couple, bolometer, or other radiation detector may be employed. He states that by using three instruments on this plan, an initial movement of a millionth of a millimetre may be made to produce a final movement of 1 mm.; this seems to be stretching the process rather far, for we should think it practically impossible to prevent infinitesimal movements of the first mirror through vibration, change of temperature, &c., which would swamp the movements due to the phenomenon under investigation—as, of course, all such chance movements would be equally magnified. The inventor recognises these difficulties, and is continuing his investigations. It is clear that the method may, and probably will, be found of great value in making delicate measurements.

A Belgian Patent Action.—According to information received in Berlin from Brussels, the Belgian Court of Appeal has just decided an action which has been proceeding for years between the A.E.G. Union Electrique, which is the Belgian branch of the Berlin A.E.G., and the Atéliers de Constructions Electriques de Charleroi. The Court of First Instance gave a decision in favour of the former, but the Court of Second Instance held that the plaintiff company was not justified in forbidding the use in Belgium of the Knight and Potter patents (patented in Belgium on July 15th, 1892), and of patents which refer to the Andersen controller (patented in England on December 4th, 1899, but not in Belgium). As a consequence the A.E.G., which is the concessionaire

of the Knight and Potter patents, and which had caused the controllers made by the Ateliers de Constructions Electriques to be seized, was ordered to pay compensation to the latter. The Court of Appeal, however, has refused to accept this interpretation of the Belgian patent law, and has restored the decision of the Court of First Instance in favour of the A.E.G.

London Electric Supply.—The L.C.C. Special Committee on the future of electric supply in London having already gone into the matter in a general sort of way with a number of well-known authorities, now asks the Council to authorise it to spend £2,500 upon obtaining detailed reports on more definite lines. The reports will, *inter alia* :—

1. Deal with the existing means for the supply of electricity in Greater London.
2. Give an outline of a complete ultimate scheme for Greater London, and indicate what modifications would be required in any such scheme if it were limited to the County of London.
3. Include a definite recommendation as to the initial steps to be taken in the direction of a complete scheme, bearing in mind the existing conditions and the general financial position.

An Extraordinary Proposition.—At a recent meeting of the Bridlington Borough Council the following resolution was put forward by one of the Councillors :—"That any official of the Bridlington Corporation receiving a salary of over £120 per annum, including emoluments, when applying for an increase of salary shall at the same time tender his resignation before such increase is considered by this Corporation." Fortunately for the reputation of the Council, the resolution was not carried. It is difficult to conceive what object the mover had in view in proposing so tyrannical a course, unless it were to discourage to the utmost future applications for an advance. One obvious result, however, would be that it would effectually discourage good men from remaining in the employ of the Corporation or from entering it. The incident affords a further indication of the narrow-minded and contemptuous attitude of some municipal representatives towards their officials—an attitude they would not dream of assuming towards the workmen in the Council's employ, whose voting power compels the respect of their representatives. We understand that the author of this iniquitous proposal is a local tradesman ; it would be interesting to know whether he has adopted the system in his own business—we do not think it likely.

Brains count for nothing in comparison with votes.

Electro-Therapeutics.—At the annual gathering of the British Medical Association which is now in progress at Hove, Mr. W. D. Butcher, M.R.C.S., London, is president of the Electro-Therapeutics Section.

Fatalities.—Tom Burrows, a workman in the employ of Burnley Corporation tramways, was engaged working on the "tower" wagon in Manchester Road last week when, through the unaccountable slipping of a binder, a wire was released, and, striking the unfortunate man, knocked him over the hand-rail into the roadway, a distance of about 17 ft., killing him instantly. The Coroner at the inquiry said that while deceased might have been safer on the other side of the wire, he (the Coroner) thought he was doing what he considered best for his employers. The jury returned a verdict of "Accidental Death."

Mr. Tee, on behalf of the Corporation, expressed deep sympathy with the family. They employed a man with 22 years' experience to bind the wires, and, so far as they knew, they had taken every precaution to prevent such a fatality happening.

On Monday an inquest was held into the death of a gantry driver, named Phillips, who was killed at the Melingriffith Tinplate Works, near Whitchurch. According to the *Western Mail*, Frederick James Lloyd, electrical fitter, who was working with Phillips, said they were engaged in putting a new hauling rope on an electrical crane, and witness was guiding a rope while Phillips was inside the "cab" working the controller. The rope jumped out of the groove. Matters were put right, and witness told Phillips to hoist again. As he did not get a reply he went to the "cab," and, to his surprise, he saw Phillips gripping the electric wire, through which a 440-volt current was passing. He switched off the current and endeavoured to save Phillips from falling against a long transverse wire, but was unsuccessful, the deceased man striking the wire with his head, the result of which was that witness also received a shock. Artificial respiration proved of no avail. Dr. Fuller, who examined the body, attributed death to heart failure, due to shock. A verdict of "Accidental Death" was returned, a rider being added that the wires were not sufficiently protected at the time of the accident. Sympathy was expressed with the bereaved relatives.

Accident.—Last week two wiremen employed in the Rochdale Corporation tramway department were repairing wires at Littleborough when a motor wagon ran into the tower wagon on which they were standing. The platform was knocked from under their feet, and the men were left hanging on to the span wire by their hands. A loaded lorry, which was close by, was quickly drawn under the men, who dropped on to it none the worse for their experience.

Institute of Metals.—The programme is issued of the autumn visit of this Institute which takes place on August 28th and 29th to Ghent.

The Production and Consumption of Copper, Lead, Tin and Zinc in 1912.—The well-known statistics which are annually issued by the Metall Gesellschaft, of Frankfort-on-Main, have just been published in relation to the production, consumption and stocks of copper, lead, tin, zinc and other metals in 1912. It is mentioned by way of introduction that in consequence of the favourable industrial development last year, the consumption of metals in general experienced such a large increase, that it was impossible for the output at times to keep pace with the demand, notwithstanding the considerable augmentation in the production. The tonnage (apparently metric) of the out-turn and consumption of the four leading classes is returned as follows, for the past two years :—

	1912. Metrical tons.	1911. Metrical tons.
Copper production and consumption.		
Production	1,019,800	893,400
Consumption	1,040,200	953,700
Tin production and consumption.		
Production	121,300	118,700
Consumption	128,100	120,600
Lead production and consumption.		
Production	1,189,100	1,132,900
Consumption	1,198,900	1,157,700
Zinc production and consumption.		
Production	977,900	902,100
Consumption	987,500	903,200

The average price of copper per long (English) ton is returned at £73 1s. 2d. in 1912, as compared with £56 1s. 9d. in 1911 ; that of tin, £209 8s. 5d., as against £192 7s. 9d. ; lead, £17 15s. 10½d., as contrasted with £13 19s. 2½d. ; and zinc, £26 3s. 4d., as compared with an average of £25 3s. 2d. in 1911. The consumption of the leading countries is set forth as undernoted :—

CONSUMPTION OF LEAD IN THE PRINCIPAL COUNTRIES.	1912. Metrical tons.	1911. Metrical tons.
Germany	220,500	229,800
United Kingdom	196,100	198,300
France	106,500	99,600
United States	397,800	365,200
CONSUMPTION OF COPPER.		
Germany	232,700	222,100
United Kingdom	144,700	159,200
France	99,800	95,700
United States	371,800	321,900
CONSUMPTION OF ZINC.		
Germany	225,800	219,300
United Kingdom	185,200	175,700
France	82,000	82,000
United States	312,400	251,600
CONSUMPTION OF TIN.		
Germany	21,700	19,300
United Kingdom	21,500	21,900
France	7,500	7,400
United States	51,700	48,000

The production of aluminium in 1912 amounted to 61,100 tons, as compared with 45,000 tons in the previous year. The United States were responsible for 18,000 tons of the former quantity, being the same as in 1911 ; France for 13,000 tons, as against 10,000 tons ; and Germany, Austria and Switzerland for 12,000 tons, as contrasted with 8,000 tons in 1911. It is estimated that the world's consumption of aluminium in 1912 reached 61,100 tons, as compared with 46,800 tons in 1911, the United States being credited with 28,000 tons and 20,900 tons in the two years respectively. The average price was 1s. 6d. per kg. (£3 15s. per cwt.), as against 1s. 2½d. per kg. in 1911, 1s. 5½d. in 1910 and 1s. 4⅝d. in 1909. Apart from quicksilver and silver, the statistics also show an output of 28,500 tons of nickel in 1912, as compared with 24,500 tons in the previous year, and the major portion of 15,000 was produced in the United States and Canada, as against 12,000 tons in 1911 ; the output in Great Britain was 5,200 tons, as compared with 4,500 tons, whilst the share of Germany in 1912 remained at 5,000 tons without any change.

Appointments Vacant.—The Commissioners for the Port of Calcutta are inviting applications for the post of assistant to the superintendent of machinery with central electric generating experience (Rs. 450 per men., plus free quarters). Apply by August 1st to Mr. J. Angus, consulting engineer and London agent to the Commissioners, 17, Victoria Street, S.W. The Egyptian Ministry of Finance is advertising for an assistant sub-director of the Government Press, Cairo ; civil and mechanical engineering education and experience in electrical power installations. Information from Secretary, Egyptian Government Selection Board, East Alla, Putney, S.W., before August 4th.

Chief clerk and accountant, for the Coventry Corporation Tramways (£180) ; wireless telegraph superintendent, for the Government stations in Somaliland (£400 + quarters) ; assistant electrical engineer, for Port Elizabeth municipality (£500) ; assistant lecturer and demonstrator, for the Borough Polytechnic Electrotechnics Department (£60). See advertisement pages to-day.

Paying Compositions "In Settlement."—In the City of London Court, on Friday, a case of much trade interest was heard before his Honour Judge Lumley Smith, K.C., in which Messrs. S. Lesser & Sons, merchants, 24, Houndsditch, E.C., sued

Mr. E. R. Hicks, 11, Penlee Street, Penzance, for £2 9s. 9d. balance of account for goods supplied in the ordinary way of trade. Defendant wrote to the Court, and said he had had a fire, and after he had received the insurance money there was only sufficient money to pay his creditors a composition of 15s. in the £. A cheque for that amount was sent *pro rata* to each of the creditors, marked "in full settlement," with an intimation that they must accept it in full discharge or return the cheque, when he would file his petition in bankruptcy or apply for an administration order, as the circumstances warranted. Plaintiffs had cashed the cheque, and therefore they had no further claim upon him. They should have returned the cheque or accepted it in full. Mr. Harry Strouts, for the plaintiffs, submitted that the plaintiffs were entitled to sue for the balance notwithstanding the fact that they had kept the cheque. They sent a receipt showing they took it on account. Judge Lumley Smith thought there had been a tendency of late to depart from that rule of law. He was not sure that the plaintiffs ought not to have given the defendant a chance to stop the cheque if he liked. On the whole, judgment would be given for the plaintiffs, with costs.

Annual Outing.—The annual outing of the employés of Electrical Installations, Ltd., took place on Saturday last, 19th inst., at Herne Bay. Although the weather in the morning was not all that could be desired, the afternoon and evening turned out very satisfactory, and, after lunch, the party amused themselves with various pastimes—motor drives, boating, &c.

Institution and Lecture Notes.—THE INSTITUTE OF MARINE ENGINEERS.—The site recently purchased on Tower Hill for the purpose of the home of this Institute, is to be cleared, and the construction of the building begun. Tenders for the work have been accepted, and it is hoped that the premises will be ready for occupation in the early part of next year. Of the required sum, £6,000 has been subscribed, and it is hoped that the remaining £6,000 will be forthcoming during the current year. To that end the committee is making its appeal over a wider area than that of the membership of the Institute. Donations for the "City Premises (Building) Fund" may be addressed to Mr. A. H. Mather, Hon. Sec, City Premises Committee, Institute of Marine Engineers, 58, Romford Road, Stratford, E.

INSTITUTION OF MECHANICAL ENGINEERS.—The Cambridge meeting takes place on July 29th and 30th, in the Senate House of the University. The Papers include one by Prof. B. Hopkinson on "A New Method of Cooling Gas Engines"; one by Mr. R. S. Whipple on "Modern Methods of Measuring Temperature," and one by Mr. R. W. Allen on "Modern Pumping Machinery for the Drainage of the Fens."

Electric Smelting of Tin Ore. — The *Revue Industrielle* gives particulars of some experiments carried out by the Groendal-Kjellin Co., of London, in Cornwall for the purpose of investigating the suitability of the electric furnace for the reduction of tin ore. The results were favourable, pure ores giving metal of 98 per cent. purity, while Bolivian ores containing 49·5 per cent. of tin and about 15 per cent. of iron yielded metal of 92 per cent. to 97 per cent. purity, which could be further refined to 99·75 per cent. or more by blowing air through the molten mass. The energy consumed amounted to 1,700 KW.-hours per ton on the average. By working with two furnaces, one to treat the rich slag and the other to produce the metal, the company hopes to reduce this consumption to 1,400 KW.-hours, giving an efficiency of 55 per cent. There is a saving of 25 per cent. of labour. It is stated that at mines where hydroelectric power is available the process will be commercially practicable and economical.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—A number of friends of MR. and Mrs. WYLD having expressed a wish to celebrate the former's appointment as chief electrical engineer to the borough of Hampstead, and to welcome both Mr. and Mrs. Wyld to London, a Committee has been formed, and it has been decided that a dinner be held on Friday, October 3rd, at the Imperial "Oddenino's" Restaurant, 60-62, Regent Street, W. The number of guests having to be limited, early applications for tickets should be made. As the dinner is to welcome both Mr. and Mrs. Wyld, single tickets will be issued for gentlemen only, and double tickets for lady and gentleman. Applications for tickets should be made to Mr. C. Newton Russell, 29, Southwood Avenue, Highgate, Chairman of Committee; or to the Hon. Sec. and Treasurer, Mr. E. P. Barfield, "Porlock," Athenæum Road, Whetstone, N.

The Greenock Town Council is granting an advance in salary of £50 to MR. JAMES A. ROBERTSON, the burgh electrical engineer.

The Aberdare U.D.C. has promoted present members of the electricity staff to the following positions under the electricity and tramways department:—MR. W. J. WILLIAMS, to be works superintendent; MR. W. T. HILDER, to be outside superintendent; and MR. G. D. MORGAN, to be chief clerk.

Acting under medical advice MR. ALFRED CLOUGH, resident electrical engineer in Liverpool, has intimated to the Tramways and Electric Power and Lighting Committee his desire to retire. The Committee have accepted the resignation as and from October 1st next, and have placed on record their appreciation of the services rendered by Mr. Clough to the Corporation and to the community in connection with the management and development of the electric supply undertaking.

Tramway Officials.—MR. GEORGE WEBSTER, traffic manager, has been appointed by the Rochdale Corporation Tramways Committee to the position of general manager in succession to MR. J. S. D. MOFFET, who has been chosen as general manager of the West Ham Tramways.

General.—The Council of the Royal Society of Arts attended at Buckingham Palace last Friday morning, when His Royal Highness the Duke of Connaught, president of the Society, presented to His Majesty the King, for nine years president and now patron of the Society, the Society's Albert Medal for the present year, "in respectful recognition of His Majesty's untiring efforts to make himself personally acquainted with the social and economical conditions of the various parts of his Dominions, and to promote the progress of Arts, Manufactures and Commerce in the United Kingdom and throughout the British Empire." The following members of the Council were among those present:—Lord Blyth; Mr. Dugald Clerk; Mr. Robert Kaye Gray; Colonel H. C. L. Holden; Sir John Cameron Lamb, C.B., C.M.G.; Sir Philip Magnus, M.P.; Mr. William Henry Maw; Sir Henry A. Miers; Mr. Francis Grant Ogilvie; Hon. Richard Clere Parsons, M.A.; Mr. Alexander Siemens; Mr. Alan A. Campbell Swinton and Sir John Wolfe-Barry.

MESSRS. GEORGE A. TOUCHE & CO., chartered accountants, London, E.C., have opened offices at Electric Railway Building, Notre Dame Avenue, Winnipeg, Canada, under the management of Mr. J. Gilmour Wylie, chartered accountant, and at McKnight Building, Minneapolis, U.S.A., under the management of Mr. Edgar C. Salvesen, chartered accountant.

It is now officially announced that MR. H. E. BLAIN, the late general manager of the West Ham Corporation Tramways, has, in consequence of the death of Mr. Joseph Carter, been appointed purchasing agent of the Underground Electric Railways Co. of London, Ltd., and the companies allied therewith.

A financial daily states that MR. H. C. WALKER, managing director of the Waygood Lift Co., has joined the board of the Humphrey Pump Co., Ltd.

MR. P. S. HAY, A.M.I.E.E., of the Aster Engineering Co., Ltd., Wembley, underwent a severe operation for appendicitis on Thursday last week at the University College Hospital, Gower Street, W.C. We are pleased to learn that he is making favourable progress toward recovery.

MR. H. E. ASHDOWN has resigned his official position as managing director of the Birmingham Mica Co., Ltd., to commence on his own account as a manufacturers' agent. His address *pro tem* is 8, Osborne Road, Handsworth, Birmingham.

Obituary.—PROF. FRANCIS GOTCH.—We regret to record the death of Prof. Gotch, which occurred in London on 15th inst. at the age of 60 years. He was Waynflete Professor of Physiology at Oxford, but he is brought within the scope of this journal by reason of his researches relating to the electrical changes in living tissue, conducted in co-operation with Sir J. Burdon Sanderson. Some years ago he delivered a most interesting lecture on electric eels to a large popular evening audience at one of the B.A. meetings.

NEW COMPANIES REGISTERED.

Electrical Apparatus Co. (1913), Ltd. (129,845).—Registered June 30th, by Young, Jones & Co., 7, Laurence Pountney Hill, E.C. Capital £90,000 in £1 shares (50,000 7 per cent. cumulative participating preference). Objects: To take over the business of electrical engineers carried on by the Electrical Apparatus Co., Ltd, at Vauxhall Works, South Lambeth Road, S.W. The subscribers (with one preference share each) are:—E. Schattner, 117, Corringham Road, Golder's Green, N.W., electrical engineer; E. A. Godson, 31, Gledhow Gardens, S.W., gentleman; R. Amberton, 9, Evelyn Mansions, Queen's Club Gardens, W., electrical engineer; G. R. Moore, 13, Spencer Road, Croydon, electrical engineer; H. Taylor, Weybourne, Foxley Lane, Purley, incorporated accountant; H. R. C. Partridge, 6, Church Row, Fulham, S.W., engineer; R. H. Barbour, Tiltwood, Crawley Down, Sussex, electrical engineer. Minimum cash subscription, £15,000; the first directors are E. Schattner (chairman), R. Amberton, G. R. Moore, H. R. C. Partridge and R. H. Barbour; H. Taylor and E. A. Godson are "extraordinary directors," and require no qualification; qualification of directors, 1,000 ordinary shares; remuneration, £2,250 per annum, divisible.

Macintosh Cable Co., Ltd. (130,053).—This company was registered on July 10th, with a capital of £25,000 in £1 shares, to carry on the business of manufacturers of and dealers in cables, chains, wires or ropes, contractors, mechanical and electrical engineers, electricians, &c. The subscribers (with one share each) are:—Frederick H. H. Smith, Queen's Lodge, Colwyn Bay, rubber manufacturer; W. Paterson, 5, Cross Street, Manchester, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are Sir Frederick H. Smith, Bart., Frederick H. H. Smith and T. H. M. Harvey. Solicitor: J. Dendy, 5, Cross Street, Manchester. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

E. M. Ashley, Ltd. (130,168).—This company was registered on July 18th, with a capital of £2,000 in £1 shares, to take over the business of an electrical engineer, carried on by E. M. Ashley, at 2, 16, 18 and 20, Bond Street, Southport. The subscribers (with one share each) are:—E. M. Ashley, 41, Balfour Road, Southport, electrical engineer; E. L. Reynolds, 16, Bond Street, Southport, electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are E. M. Ashley, E. L. Reynolds and Sarah Ashley; qualification, £50; remuneration as fixed by the company. Solicitor: G. H. Thompson, 6, Lord Street, Liverpool. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

United Salt and Power Co., Ltd. (130,211).—This company was registered on July 19th, with a capital of £250,000 in 225,000 preference shares of £1 each, and 150,000 ordinary shares of 2s. each, to carry on the business of rock salt proprietors, salt miners, brine owners, manufacturers of salt of all kinds, producers, refiners and preparers for market of and dealers in salt, brine, and other substances and liquids producing or produced by or with the aid of salt or brine; owners and workers of salt mines and brine lands in any part of the world, chemical manufacturers, dyers, soap makers, suppliers of electricity, electrical, civil, mechanical and mining engineers, contractors for light, power and heat, &c., and to adopt an agreement with J. L. Brodie. The subscribers (with one preference share each) are:—A. S. Stern, 47, Tabley Road, Tufnell Park, N., clerk; H. H. Walton, 55, Chapter Road, Kennington, S.E., clerk; S. R. Disborough, 8, Denmark Street Park, Tottenham, N., clerk; L. H. Hiscock, 15, Lonsdale Square, Barnsbury, N., clerk; S. Price, 2, Barretts Grove, Stoke Newington, N., clerk; H. E. Williams, 18, Austin Friars, E.C., solicitor; P. J. Hellis, 46, Arthurdon Road, Ladywell, S.E., secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the first are W. T. Holmes, 1, Queen Victoria Street, E.C.; Sir Murland de Grasse Evans, Bart., 27, Old Jewry, E.C.; A. H. Barnard, 148, Fenchurch Street, E.C.; L. Charbonnel, Finsbury Pavement House, E.C.; and C. Gairdner, 13, Fenchurch Avenue, E.C.; qualification, £200; remuneration, £200 each per annum (chairman £300), and 2½ per cent. of the profits, divisible. Registered by Slaughter & May, 18, Austin Friars, E.C.

Hydraulic Power Co., of Scandinavia, Ltd. (130,171).—Registered July 18th, by Ingle, Holmes, Sons & Pott, Capel House, E.C. Capital £425,000 in 10s. shares. Objects: To carry on the business of a water and general power company, to manufacture, generate, sell and supply electricity for power or other purposes and machinery for the generation of electricity, to acquire rights and concessions in respect of the use of waterfalls, rivers and waterways, &c., and to adopt an agreement with the Hydraulic Power and Smelting Co., Ltd. The signatories (with one share each) are:—H. V. Young, 41, Bismarck Road, Highgate, N., clerk; F. T. Linell, Lowood, The Beeches, Carshalton, solicitor; H. Jacques, Elstree Cottage, Victoria Road, Mill Hill, N.W., clerk; E. V. Staff, 18, St. Swithin's Lane, E.C., secretary; W. V. Pooley, 60, Farleigh Road, Stoke Newington, N., clerk; J. Nash, 145, Shernhall Street, Walthamstow, clerk; E. J. Hayman, 18, St. Swithin's Lane, E.C., secretary. Minimum cash subscription upon the first allotment of shares, seven shares; if at any time shares be offered to the public the minimum subscription shall be 10 per cent. of the shares offered; the first directors (to number not less than two or more than five) are R. Blakstad, S. Huldt, A. List, E. Rarel and J. A. Stirling; remuneration, £100 each per annum.

Teleradio Electric Co., Ltd. (130 183).—This company was registered on July 18th, with a capital of £8,000 in 7,900 ordinary shares of £1 each and 2,000 deferred shares of 1s. each, to acquire from the Société Française Radio-Electrique licences and powers to use patent rights, to enter into an agreement with the said Société and Emile Girardeau, to construct, establish, install, erect and work wireless, electric or other systems of telegraphy, radio-telegraphy, radiophony or telephony, to acquire any inventions for the production of light, heat, sound waves, electromagnetic waves, power or other effects by electricity or other power or agency, &c. The subscribers (with one share each) are:—A. E. Hutton, 55, Kimberley Road, Stockwell, S.W., clerk; J. Hyland, 99, Eton Road, Ilford, cashier. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration, £50 each per annum. No notice of registered office was filed with the original documents. Registered by Roney & Co., 42, New Broad Street, E.C.

Burnham and District Electric Supply Co., Ltd. (130,139).—This company was registered on July 17th, with a capital of £8,000 in £1 shares, to carry on the business of electrical engineers and contractors, electricians, manufacturers of electrical apparatus, suppliers of electricity, &c. The subscribers are:—J. A. Purvis, 6, Pennsylvania Park, Exeter, engineer, 100 shares; Wm. L. Chown, Kyrtonia, Lympstone, engineer, 1 share; Wm. T. Purvis, 13, Albany Street, Edinburgh, consulting engineer, 1 share; T. Cox, Victoria Street, Burnham, auctioneer, 25 shares; W. J. Pople, Woodlands, Burnham, builder, 5 shares; W. Barrons, 4, Redlands, Tiverton, retired surveyor, 50 shares; Wm. Lawrence, 31, College Street, Burnham, butcher, 50 shares. Minimum cash subscription, £2,500. The number of directors is not to be less than three or more than five; the first are T. Cox, Wm. Barrons and Wm. Lawrence; qualification, £25; remuneration as fixed by the company; solicitor, G. A. Morgan, 1, Woodbury Lane, Clifton, Bristol. Registered by Waterlow Brothers & Layton, Ltd., Birchin Lane, E.C.

Percy G. Green & Co., Ltd. (130,003).—This company was registered on July 8th, with a capital of £8,000 in £1 shares (4,000 preferred), to take over the business of an electric wire coverer, cable manufacturer, and dealer in ropes, yarn, woven wire and wire goods carried on by P. G. Green, of the Paragon Wire Mills, 10 and 12, Norman's Buildings, St. Luke's, E.C. The subscribers are:—A. Sissons, Hillside, Horsell, Surrey, accountant, 100 shares; P. G. Green, Lacksley, Chingford, manufacturer, 1 share. Private company. The number of directors is not to be less than two or more than five; the first are A. Sissons and P. G. Green; qualification, 100 shares. Registered office, 10 and 12, Norman's Buildings, St. Luke's, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dacolight Engineering Co., Ltd.—Particulars of £1,500 debentures, created July 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Lea, Son & Co., Ltd.—Particulars of £2,000 debentures, created June 18th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount now being issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction in full on June 27th, 1913, of debentures dated October 26th, 1912, securing £500, has also been notified.

City of Las Palmas Water and Power Co., Ltd.—Trust deed dated June 12th, 1913, to secure £237,000 first mortgage debenture stock, at 5 per cent. interest, charged on a concession for works and services for the supply of water and utilisation of water for providing electricity granted by the Municipality of Las Palmas to Bernardo de la Torre y Comminges, and all lands, works, buildings and fixed plant in connection therewith capable of being specifically mortgaged, together with all income derived from or received in respect of the said concession, and company's undertaking and other assets, present and future, including uncalled capital. Trustees: The Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, Old Broad Street, E.C. The company assigns to the trustees all amounts by way of penalty it may become entitled to under a contract dated November 15th, 1912.

Thompson Bros. (Blackburn), Ltd.—Particulars of £1,000 debs., created June 24th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Helsby Wireless Telegraph Co., Ltd.—Particulars of £2,510 debs., created June 19th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Naylorgraph, Ltd.—Second debenture, dated June 25th, 1913, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital (subject to prior debenture for £1,000). Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Lamplough & Son, Ltd.—Mortgage on the company's undertaking and property, present and future, including uncalled capital, dated June 17th, 1913, created by the receiver and manager, to secure £500. Holders: A. H. P. Strickland and H. Horne, 97, Fleet Street, E.C.

Bridgwater and District Electric Supply and Traction Co., Ltd. (75,429).—Return dated May 14th, 1913. Capital, £20,000 in £1 shares (5,000 pref.); 12,899 ord. and 525 pref. shares taken up; £1 per share called up on 4,017 ord. and 525 pref.; £4,552 paid, including £10 on 100 forfeited shares; £8 882 considered as paid on the remaining ord. shares. Mortgages and charges: £12,000.

British Insulated and Helsby Cables, Ltd. (52,285).—Return dated March 31st, 1913. Capital, £1,000,000 in £5 shares (100,000 pref. and 100,000 ord.); all shares taken up; £573,675 paid on 74,470 pref. and 40,065 ord.; £427,325 considered as paid on the remainder. Mortgages and charges: £700,000.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—Return dated June 4th, 1913. Capital stated in return as £750,000 in £5 shares (75,000 pref. and 90,000 ord.). Balance-sheet says £825,000, which appears to be correct. £825 considered as paid. Mortgages and charges: £450,000.

Brook, Hirst & Co., Ltd. (95,264).—Return dated January 7th, 1913. Capital, £20,000 in £1 shares; £12,500 shares taken up; £12,500 paid. Mortgages and charges: £7,000.

Egham and Staines Electricity Co., Ltd.—Issue on June 26th, 1913, of £400 debentures, part of a series of which particulars have already been filed.

Woodbridge and District Electric Light Co., Ltd.—Particulars of £2,000 debentures, created February 27th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd.—Issue on July 10th, 1913, of £129 debentures, part of a series of which particulars have already been filed.

Samuel Greatrix, jun., and Brother, Ltd.—Particulars of £30,000 second debentures, created May 13th, 1898, and having the benefit of a trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £4,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and Alport Works, Quay Street, Manchester. Trustee: G. W. Fox.

I. Frankenburg & Co., Ltd.—Notice is given that a mortgage debt of £15,000 existing on property purchased and advised as outstanding pursuant to Sec. 12 of the 1907 Act, was satisfied to the full extent on June 1st, 1913.

CITY NOTES.

Paignton Electric Light Co., Ltd.

AT the annual meeting the directors reported that the whole of the machinery and plant, including the refuse destructor, was working in a very satisfactory manner, and the supply of current had been given uninterruptedly throughout the year. Additional traction plant was found necessary in order to give the maximum of 250 KW. to the Torquay and Paignton tramways, and this had been erected at a cost of £1,500. Since December 31st a supplemental agreement had been entered into between the two companies for the additional energy required by the tramway company. The amount expended on capital works during the year was £3,064. Ordinary shares had been issued to the extent of £1,255, and a further 500 second mortgage debentures had been issued. Trading showed a profit of £787, and from this £427 was taken for depreciation and £27 10s. towards reduction of the debenture suspense account, leaving a gross profit of £332. The sale of electricity for the past year had increased from £1,667 to £2,694. The directors congratulated the shareholders on the rapid development of the business, and had little doubt that in the near future a remunerative dividend would be payable.

MR. W. J. HAM, C.C., the chairman, said they were doing much better than they expected in five years, but they had been, unfortunately, obliged to spend more in capital than was raised by shares. Had the balance of shares (£3,420) been taken up, the income would have been £150 a year better for the last two years, while the coal strike cost them £800 in extra price and carriage.

The report was adopted.

In reply to questions, the CHAIRMAN said that if the shares were all taken up, the company could start with about a 3 per cent. dividend.

Metropolitan District Railway Co.—A distribution at the rate of 2½ per cent. on the second preference stock, as compared with 2 per cent. a year ago, is announced.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary capital stock.

Liverpool Overhead Railway Co.—The directors have declared interim dividends at the rate of 5 per cent. per annum on the preference shares and 2½ per cent. per annum on the ordinary shares, for the half-year, against 2 per cent. per annum for the corresponding period last year.

Yorkshire Electric Power Co.

THE directors in reporting on the progress of the company say that there has been a considerable increase in the revenue from the sale of current for the past half-year, but the gross profit has been adversely affected by the high price of coal. The gross profit on the revenue account for the three corresponding half-yearly periods ending June 30th is :—

To June 30th, 1913, £10,240.
To June 30th, 1912, £5,805.
To June 30th, 1911, £6,633.

The net profit after payment of mortgage interest for the same periods is :—£6,972, £3,349 and £4,137. The balance available, including £645 brought forward from 1912, is £7,616. The directors recommend a dividend for the half-year ending June 30th, 1913, at the rate of 6 per cent. per annum on the cumulative preference shares amounting to £3,308, carrying forward £4,309. In addition to the current supplied to new customers during the half-year, there has been a steady increase in the amount required by existing consumers, who have continued to add to the machinery already driven from the company's mains. The station for generating current from waste heat at Barugh will shortly be at work, and will, when completed, add a further 5,000 KW. to the generating plant, with considerable increase to the security and efficiency of the company's supply. At the date of this report (July 15th) one-half of the recent issue of £50,000 of 6 per cent. cumulative preference shares of this company, and £17,450 of the issue of £25,000 of 5½ per cent. first mortgage debenture stock of Yorkshire Waste Heat Co., Ltd., had been applied for. Applications continue to be received, and the directors anticipate that the whole of both issues will shortly be taken up. Mr. Frederick James Kitson, of Leeds, has accepted a seat on the board. As a result of the company's increasing business new head office accommodation has been provided at Wellington Road, Dewsbury, to which address all communications should now be sent.

Consolidated Electrical Co., Ltd.

THE directors' report for the year ending March 31st, 1913, states that the ordinary income for the period under review amounted to £6,004, in comparison with £5,605 for the previous financial year. In addition a profit of £12,545 was made on the sale of 70,000 shares in the Anglo-Portuguese Telephone Co., Ltd. The general charges for the year amounted to £1,252, in comparison with £1,286 for the preceding 12 months. Out of the profits of the year the directors have written off capital suspense account £542, realisation of assets account £635, and off investments £7,500, the last-named sum representing the company's holding of debentures in the Consolidated Supply Co., Ltd., which—as the shareholders had already been informed—had long ceased to have more than a nominal value. Of the balance of £9,700 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1913, absorbed £450, leaving a disposable balance of £9,250. The final dividend of 3 per cent. paid on the preference shares on the 1st inst. absorbed a further £450, and the directors now recommend the payment of a dividend on the ordinary shares of 3¾ per cent. for the year ending March 31st, 1913. This will require £4,125 and leave a balance of £4,675 to be carried forward. The directors are satisfied that the valuation placed upon the company's investments in the balance-sheet is within their intrinsic and realisable worth. These and the cash balances represent the liquid assets of the company. "The directors intend, at the forthcoming general meeting, to consult with the shareholders as to the future of the company."

The eleventh ordinary general meeting was held at the Institute of Chartered Accountants, Moorgate Place, E.C., on Monday, Mr. H. Allen presiding.

The CHAIRMAN, in moving the adoption of the above report, said it would be remembered that they turned over the manufacturing business to the Consolidated Supply Co., but that company did not manage to make the works pay, and as that asset was not of any tangible value they thought it better to write it off. A year ago they paid a dividend of 3½ per cent. on the ordinary shares, free of income-tax, and they now recommended a dividend of 3¾ per cent., less income-tax, which was practically the same thing as 3½ per cent., free of income-tax. Personally, he thought it was a great mistake to pay dividends free of income-tax. In the report the directors stated that they were satisfied that the valuation placed upon the company's investments in the balance-sheet was within their intrinsic and realisable worth, and these and the cash balances represented the liquid assets of the company. In regard to their investments, the whole of them were readily realisable, and they could realise them to-day at a profit. At the present time they realised a fair amount of interest. The Chairman reverted to the sale of the shares in the Anglo-Portuguese Telephone Co., and said they were quite satisfied with the price they got from the shares. In the report they referred to the future of the company, and they invited the shareholders' opinions on that question.

MR. C. WOOLLEY seconded the motion.

MR. WETHERALL said he was sorry that the directors had sold the shares in the Anglo-Portuguese Telephone Co., and he thought it would have been better if they had had the value of the shares in kind rather than in cash. He thought if that had been done a higher price would have been obtained for the shares. He felt that the company should be wound up; for, whilst he had very great respect for the chairman and directors, he preferred to invest his own money, and he did not like to go into trust corporations. They should get whatever they could in cash, and he would urge the liquidation of the company.

MR. DAVIES asked what they would get per share in the event of winding up.

DR. OWEN agreed with Mr. Wetherall in the views he had expressed as to winding up.

Further discussion ensued, and the CHAIRMAN, replying, said their control of the Anglo-Portuguese Co. had been a successful control, but there was nothing to hold the shares for any longer. The state of Portugal was anything but satisfactory, and none of them could see what course events would take there in the next few years. The directors sold the shares with the best intentions and with the best results, and he did not think that any other board could have got the price they did. They got 25s. per share, and Mr. Wetherall must remember that if he had the shares in kind, he would not have had 25s. a share but £1 shares. The Consolidated Supply Co. was in liquidation, and they had done with that company. If they decided to wind up, the shareholders would get a little over 10s. per share after the expenses of liquidation were met. The chairman stated that Mr. Michall had sent in a series of questions, and having dealt with them, he went on to refer to the proposed winding up of the company, and said they had a large body of shareholders to whom it would be a very great source of regret if they should have to do so. But the directors felt that the time had come when the company should be wound up, and they thought that they might have been able to prepare some scheme to put before them that day. That they had not been able to do, but probably there would be an early winding up of the company with a distribution of the assets in cash.

The report was then adopted.

In the course of further discussion, several shareholders were anxious to submit a resolution in favour of winding up, but this, it was pointed out, could not be submitted that day, and Mr. Kingsbury said that in view of the record of the company they would hardly be justified in passing such a resolution, and the chairman said that probably within a few weeks proposals would be submitted for the almost immediate winding up of the company and the realisation of the assets.

A vote of thanks to the chairman terminated the proceedings.

Chatham and District Light Railways Co.—The directors' report for the half-year ended June 30th, 1913, shows that the revenue was £23,070 and the expenses were £13,068, leaving £10,002, less rent of Rochester Corporation lines £1,872, interest on debentures £1,058, interest account £338, leaving £6,734, plus £562 brought forward. Out of the balance of £7,296, £2,940 is required for dividend at the rate of 5 per cent. per annum for the half-year on the preference share capital, £1,590 for dividend at the rate of 3 per cent. per annum for the half-year on the ordinary share capital, and £2,766 is to be carried to revenue new account. The traffic receipts show an increase of £1,143, and the expenses an increase of £657, as compared with the receipts and expenses for the corresponding half-year of 1912, the increase in expenses being mainly due to the enhanced price of coal. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Minas Geraes Electric Light and Tramways Co. (Companhia de Electricidade e Viacao Urbana de Minas Geraes).—£120,000 5 per cent. first mortgage bonds (Nos. A 1 to 1,000 of £20, and B 1 to 1,000 of £100 each).

United River Plate Telephone Co., Ltd.—Further issue of 54,000 ordinary shares of £5 each, fully and partly (£3) paid.

And to allow the following securities to be quoted in the Official List :—

La Plata Electric Tramways Co., Ltd.—30,000 additional 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 170,001 to 200,000).

Central London Railway Co.—The Underground Electric Railways Co. announce that the Central London Railway holders of non-assenting stocks will receive a dividend in respect of the undivided ordinary stock at the rate of 3 per cent. per annum, and on the preferred ordinary stock at the rate of 4 per cent. per annum. The dividend on the deferred ordinary stock is not payable until the results of the working for the year to December 31st have been ascertained. Those shareholders who are registered holders of the guaranteed assented ordinary, guaranteed assented preferred ordinary, and guaranteed assented deferred ordinary stocks, will receive a dividend at the rate of 4 per cent. per annum on September 1st.

London and Suburban Traction Co., Ltd.—The directors have declared the full dividend on the 5 per cent. cumulative preference shares for the half-year ended June 30th.

London Electric Railway Co.—An interim dividend is announced on the 4 per cent. preference stock at the rate of 4 per cent. per annum, and on the £10 ordinary shares at the rate of 1 per cent. per annum.

Kaministiquia Power Co.—The directors have declared a dividend of 1¼ per cent., or at the rate of 5 per cent. per annum, on the common shares for the quarter ending 31st inst.

South American Light and Power Co., Ltd.

MR. T. PENN GASKELL, M.Inst.,C.E., chairman, presided on Tuesday at Dashwood House, E.C., over the tenth annual general meeting of the above company.

In moving the adoption of the report, the CHAIRMAN said they were able to pay a dividend of 5 per cent. on the shares this year, against 4 per cent. last year, and that was after writing off £912 against the expenses of the debenture issue. Since the close of the financial year, they had received a return from April, which was the first month of the current year, and this showed a profit of about £600 over the corresponding month of last year, or about 15 per cent. If that went on, and from all accounts Blanca was in a much more prosperous condition than it was last year, they might expect an increase in the dividend next year. Probably it would be an increase of 1 per cent., or something of that kind, for they had quite a large deficiency against the debenture issue, and they would like to pay off some of that deficit. He did not know that there was anything special to call attention to, for the business of the company seemed to be progressing very satisfactorily.

MR. E. CHARRINGTON, in seconding the motion, said the most satisfactory feature of the year was that they had increased the number of their consumers from 1,381 to 1,706. The company was going ahead now. The capital expenditure was very moderate last year, and they had now only to go on increasing the cables and connecting consumers. That was their chief source of expenditure, and was bound to increase. They had got into smooth water and were bound to go ahead.

The report was adopted.

Ceara Tramway Light and Power Co., Ltd.

THE report to June 30th last, states that the company was registered on December 11th, 1911, but did not commence active operations until June, 1912, when it definitely took over from the vendors the mule tramway and concession for electrification. A contract was entered into about the same time with the South American Railway Construction Co., Ltd., for the complete electrification of the tramway system and the establishment of a lighting and power installation. Under the construction contract the contractors undertake, until the final handing over of the completed electric system, to work the existing mule system and to bear and pay all the expenses of this company (including the interest on the debenture stock). The contractors report that the receipts of the mule tramways are very satisfactory, notwithstanding the disorganisation caused by the electrification work. There have been considerable delays in the prosecution of the electrification work, but from the latest reports from the company's resident engineer satisfactory progress is now being made, and the starting up of the first section of the tramway may be expected shortly.

MR. CHARLES HUNT presided at the offices, 42, New Broad Street, E.C., on Monday, over the first annual meeting of the company. In moving the adoption of the above report, he said that the accounts were of very little interest to them as shareholders, and, were it not for the provisions of the law which provided that a general meeting must be held about this time, it might have been deemed convenient to have deferred calling them together until a later time, when information and figures of a more vital character could be placed before them. They were a company which, at the moment, was not in working possession of its property, but was simply waiting the time when its contractors should have completed the works which they had contracted to carry out, when they would be handed over to them in a complete working state. It was anticipated that that time would have arrived ere this, but delays, unavoidable for the most part, had occurred in the construction work, which would have the effect of deferring for a short time the taking over by the company of the working of the new installation, but the consulting engineers estimated that the power installation would be sufficiently advanced to allow the starting up of the first section of the new system about the end of August. The consequences of these delays, however, did not fall upon the company, as, until the handing over took place, the contractors were liable to defray all the expenses of the company, including the interest upon its issued debenture stock. Through their consulting engineers, the board were keeping closely in touch with the work being carried out by the contractors, and felt confident that the company's interests were being well watched. The selection of a competent staff was also a matter to which the board were directing their attention. It would be obvious that the company must be quite ready in this respect when the time arrived to take over the working of its property. The board had conferred on this matter with the contractors with a view to preserving, as far as possible, some continuity in the technical and business management of the tramways, and it had already been arranged that the gentlemen selected by the company for the chief direction of its local affairs should be employed by the contractors in connection with the construction works and management of the existing tramways, so that, when the time came for the company to assume responsibility for working, its chief employés would already have had a fair acquaintance with the property which it would be their business to direct. In accordance with this arrangement, the gentleman who had been selected by the board as their general manager, Mr. E. M. O. Scott, was now in Ceará acting as the manager of the existing mule system for the contractors. The secretary, who was at present in Ceará, would during his stay there, confer with Mr. Scott upon the various matters which would require attention before the company was ready to take over. Although not directly concerned, the board obtained from time to time information respecting the traffic movements on the existing mule tramway, and he was glad to say that, in spite of the certain amount of disorganisation necessarily attendant upon the electrification work, the figures indcated progressive movement. Reports which had also been received from the consulting engineers and others indicated that the prospects of the electrified system were even more favourable than was originally considered. The track would be extended 47 per cent., and the car service trebled, and, judging from the present receipts from the disorganised mule tramway, the receipts from the electrified tramway system, when completed, should largely exceed the original estimate. He, therefore, looked forward with confidence to meeting them at subsequent gatherings, feeling that they were interested in a property which had a solid prospect of a prosperous future, and that the results of working an electric tramway, light and power business in Ceará would prove as favourable as had been the case with other concerns of a like nature in South America.

MR. A. A. CAMPBELL SWINTON seconded the resolution, which was carried without discussion.

Prospectuses.—*The United Salt and Power Co., Ltd.*—The list is to close to-day in an issue of 235,000 6 per cent. cumulative participating preference shares of £1 each in this company, which is formed to acquire Patent No. 28,171 of 1911, relating to the Brodie process for the manufacture of salt and electrical power, to purchase 14 acres of proved brine land at Middlewich, Cheshire, together with preliminary plant erected there by Mr. Brodie for the purpose of demonstrating the working of the process under ordinary conditions. It is estimated that with a plant capable of manufacturing 400,000 tons of salt per annum, the steam available would suffice to produce 2,000 KW. of electrical power, which would be treated as a by-product, and "if sold at the extremely low price of ¼d. per unit, would produce an additional £10,000 per annum net profit for the company." No difficulty is anticipated in selling the surplus power. Tenders received from Messrs. Mirrlees, Watson, Messrs. Manlove, Alliott & Co., and Messrs. Babcock & Wilcox, show that the complete plant of the company can be put down for £120,000. Reports have been prepared by Mr. J. Swinburne and Messrs. Baillie & Dobrée, and their estimates of profits show £82,083 profit available before allowing for management and administration expenses, or for preference dividend.

Bristol Tramways and Carriage Co., Ltd.—The list was to close on Wednesday in an issue of a further £250,000 4½ per cent. mortgage debenture stock at 92½ per cent. The money is to be used to meet outlays made, or to be made, in connection with the development of the motor and motor-omnibus services.

R. Waygood & Co., Ltd.—We read in the financial Press that the recent share issue was largely over-subscribed.

Lanarkshire Tramways Co.—The directors' report for the half-year ended June 30th, 1913, states that the revenue was £43,450, and the expenses were £24,655, leaving £18,794, less contributions payable to local authorities £1,433, interest on debentures £911, and interest account £644, leaving £15,806, plus £1,577 brought forward, making the balance £17,383. £10,290 is to be absorbed by a dividend at the rate of 6 per cent. per annum for the half-year on the share capital, £7,093 being carried to revenue new account. The traffic receipts for the half-year show an increase of £6,314, and the expenses an increase of £3,182, as compared with the receipts and expenses for the corresponding half-year of 1912. A service of motor-'buses was inaugurated during the half-year, and commenced running in April between Newarthill and Cleekhimin, but the result so far, from the company's point of view, has not been satisfactory. The Lanark County Council are proceeding with the construction of tramways from Uddingston to Bellshill, Mossend and New Stevenston. It is anticipated that part of the tramways will be in operation by the end of August and the remainder by the end of October. These tramways will be leased to the company under the agreement with the Lanark County Council. Twelve cars have been ordered to meet the additional traffic, and the car-shed is being extended. The directors will, as usual, provide for depreciation in the accounts to December 31st next.

Bulawayo Waterworks Co., Ltd.—In their report for the year ended December 31st, the directors say that the total demand for electric supply during the year from all sources amounted to 260,961 units as compared with 140,500 for 1911, the gross profit being £8,651, as compared with £6,840. Included in the above total are 61,599 units required for pumping water and 41,921 units for electric power. It is expected that the demand for power purposes will steadily increase.

City and South London Railway Co.—Interim dividend for the first half of the year ending December 31st next on the 5 per cent. preference stocks, 1891, 1896, 1901, and 1903, at the rate of 5 per cent. per annum: on the consolidated ordinary stock at the rate of ¼ per cent. per annum.

St. James's and Pall Mall Electric Light Co., Ltd.—Interim dividend for the June half-year at the rate of 10 per cent per annum as last year.

Chili Telephone Co., Ltd.

MR. GEO. KEITH (chairman) presided on July 17th, at the offices, 42, Old Broad Street, E.C., over the meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 69), said that the business had made excellent progress during the year under review. The gross revenue in Chile had increased during the year about 23 per cent., which improvement was partly due to the adjustment of the rates to meet the lower value of the currency and partly to the general expansion of business throughout the company's system, especially in the large centres of population, Santiago, Valparaiso and Concepcion. The working expenses in Chile amounted to 48 per cent. of the revenue or a decrease of 1 per cent., which had added considerably to the net currency revenue, but, on the other hand, the sterling value had suffered somewhat from the lower average rate of exchange which came out at about ¼d. less than it did the year before. As to the revenue account, the net income from Chile showed an increase for the year of £10,413. Interest brought in £748 less due to the sale of some of their securities during the year. The London office expenses showed an increase of £34, and income-tax was £109 more. The result of the year's business was a credit balance of £58,388, of which £17,565 was expended in Chile on replacing and improving plant, and £13,904 had been carried to reserve. The reserve account now stood at £76,000, whilst the capital expenditure account was increased by £17,874, expended during the year on extending the property and plant in Chile. The investments remained the same as last year. He congratulated the shareholders on the result of the year's operations. A large amount of constructive work had been carried out during the year to meet the growing requirements of the business. The placing of the lines underground in the City of Santiago had been satisfactorily proceeding; the trunk and junction lines at various centres had been largely increased and extended; and 17 new provincial offices had been opened for service throughout the central and southern districts. For some years past the company had acted in an advisory capacity for the Ecuador Telephone Co., and lately an opportunity presented itself for acquiring the undertaking for a nominal sum. The directors, thinking that with care and perseverance they would be able to improve it, took over the concern, and it was now being worked as a subsidiary company. The prosperous condition of Chile was steadily improving, and the nitrate and other industries were doing well. The longitudinal railway was now open for traffic between Santiago and Serena, and it was expected the whole line would be completed this year. Great progress was also being made in port and other public works, all of which would contribute to the general prosperity in which their company would participate. He thought they might be well satisfied with the position of the company. Its relations with the Government and the authorities in Chile were very cordial and the business was being most ably managed by the staff.

The Hon. H. F. ALLSOPP seconded the motion, and it was carried.

Mr. Keith was re-elected a director, and the meeting closed with a vote of thanks to the board.

Japan.—A proposal to amalgamate the business of the Tokio Electric Light Co. and the Nippon Electric Light Co. is just now attracting considerable attention, and is the cause of great discussion in the Japanese capital. In connection with the matter, the following summary of the different electric lighting undertakings in Tokio may be of interest:—

	Authorised capital.	Capital paid up.
Tokio Electric Light Co.	£5,000,000	£3,440,000
Nippon Electric Light Co	1,200,000	300,000
Katsuragawa Hydro-Electric Co. ...	800,000	400,000
Kinugawa Hydro-Electric Co.... ...	1,350,000	993,000
City Electric Bureau	950,000	950,000
	£9,300,000	£6,083,000

The amount of capital raised in connection with the organisation of new electrical companies and the extension of old concerns in Japan during the first half of the current year amounted to £3,499,700, an increase of £2,194,200 over the corresponding six months of 1912.

The Keisei Electric Railway Co. is paying a dividend of 5 per cent., out of a net profit of £3,222.

Continental.—FRANCE.—A new company has just been formed in Paris (23, Rue de Rome) with a capital of £50,000 and the title La Société des Aciéries Electriques de Paris et de la Seine.

SWITZERLAND.—La Société Electro-Metallurgique des Procédés Paul Girod, of Neuchatel, is being reorganised. The present capital of £480,000 is being written down to £288,000, and new shares issued to bring it back to the original amount.

The Gesellschaft Brown-Boveri Co., of Baden, reports a gross profit of £298,000 for the last financial year, as compared with only £225,730 in the preceding 12 months. The dividend is being increased from 7 to 8 per cent. It is also proposed to increase the capital of the company from £1,120,000 to £1,280,000.

Crompton & Co., Ltd.—Mr. E. Reeves, the liquidator, announces that the company having gone into voluntary liquidation for the purpose of reconstruction, the short term notes of the old company are now repayable. Bearers will be entitled, on presentation of their notes (before July 31st), to receive payment of the principal sums due, with interest from May 1st.

Blackpool and Fleetwood Tramroad Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

THE markets of the Stock Exchange have regained a certain amount of buoyancy by reason of the renewed expectations of peace "breaking out" in the Balkans. Bears began to buy stock, and, on the strength of this, the House, as a whole, assumed a more cheerful complexion. Business on behalf of the general public was not, however, greatly stimulated, and, in view of past experience, a good many people elected to wait for further developments before believing the Balkans war to be really over.

Money Market conditions remain easier, but the best-informed quarters look for no fall in the Bank Rate. The idea is that the current minimum will remain in force until the usual autumn drain for gold sets in, when it may become necessary to raise the rate.

Home Railway dividend declarations opened with the announcement by the District Company of 2½ per cent. on the Second Preference, against 2 per cent. this time last year. The market regarded this as somewhat colourless, and the price of Districts did not move. The Second Preference stock has not yet been issued to the public; it is all held by the Underground Electric Railways, and the full rate to which it is entitled is 5 per cent. In Central London Ordinary the usual 3 per cent. has been declared; the only changes here are rises of 1 apiece in the Ordinary and Preferred Guaranteed Assented stocks. City and South London Ordinary gets ¼ per cent., as against 1¼ per cent. a year ago, but this, of course, is no longer quoted separately. The London Electric Ordinary shares will receive 1 per cent.; the 4 per cent. Debenture stock remains at 92.

Metropolitan Consolidated is ½ lower, but Great Northern and City Preferred shares have risen 5s. to 2¼, which is supposed to represent, roughly, the equivalent of Metropolitan Railway stock, to which holders will be entitled when it is exchanged for the shares. London and Suburban Traction 4½ per cent. Debenture stock dropped back to 70, holders being apparently frightened by the recently-advertised misfortunes that have befallen tramway enterprise in London. London United Tramways Debenture is a point lower at 58 for a similar reason. The London General Omnibus Company announces a dividend of 8 per cent. actual, but Underground Electric Railways "A" shares eased off a little. The £10 shares remained at 3½, while the 4½ per cent. bonds, on publication of the 'Bus Company's figures, rose 2 to 99. A new comer, Greater Omnibus Services, Ltd., has appeared this week, with a prospectus that aroused a good deal of criticism. The appeal to the public was based in no small measure upon the success of the London General Omnibus Company.

Changes amongst London Electricity Supply shares take the form of two small falls in Preference issues, and ⅛ rise in Westminster Preference. City 5 per cent. Debenture rose 1. Edmundson's Debenture is a point lower. Hove shares are up 5s. The market, as a whole, lacks interest, and business has fallen away to retail proportions. Electric Construction Preference are ⅛ higher, at 2 middle. British Westinghouse 4 per cent. Debenture shed 1, which was gained by the company's prior lien Debenture. Babcock & Wilcox shares are $\frac{1}{32}$ easier. Shareholders are inquiring in what way the Admiralty's change of fuel is likely to affect, if at all, the Babcock Company. It may be observed, as a matter of curiosity, that proprietors in some of the colliery concerns are somewhat perturbed by Mr. Winston Churchill's speech in favour of oil.

Callender's, ⅛ up at 11, may be said to have recovered from the slight pressure to liquidate the deceased account, brief reference to which was made here last week. India-Rubber shares are ¼ higher at 11¾.

There has been some recovery in Mexican issues, after their long and severe drop. News from the country is the reverse of reassuring, but it is contended that prices have had such a slump as discounts to a large extent the risks that remain. Mexican Tramways Sixes are again 2 points down, but in Mexican Light and Power Preferred there is a rally of similar amount, and the slant in the price of the Common shares has been stayed. Rio Tramway bonds, too, are firmer, the Firsts and Seconds both going up ½. British Columbia Railway stocks show advances. Shawinigan Water Capital stock fell 1, but the 4½ per cent. Debenture is 1½ to the good.

Further offering of Anglo-Argentine Tramways Second Preference reduced the price at one time to $4\frac{3}{16}$, from which there was a recovery to $4\frac{5}{16}$, leaving the shares $\frac{1}{16}$ down on the week. The 5 per cent. Debenture at 97 is ½ better. Manila Bonds have hardened. Rangoon Preference fell ¼. Brazilian Traction remain at 88.

The revolution in China caused Eastern Extensions to lose ⅛, the group, however, being hard as a whole. Eastern 4 per cent. Debenture rose 1½. Globe Preference and Western Telegraphs are both ⅛ down. New York Telephones continue to be bought with persistency; another point advance has been scored. Telephone of Egypt Debenture has risen ½. National Telephone Deferred, after fluctuating with freedom, settled to 28½. Reuter's remain a weak market. The shares have gone back to 9¼ middle.

Pending the declaration of the dividend, Marconis kept very close to $3\frac{1}{16}$, at which they were $\frac{1}{16}$ better on the week. The terms proposed for the new contract with the British Government are being studied with lively interest in the market. American Marconi's went up a little, to 17s., but soon reverted to 16s. 3d., and in Canadians the movements have been equally slight, the price at the moment being 9s. 6d. buyers.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	£10	5½	6	9⅛ — 10⅛	..	5 14 3
Do. 4½ % Pref.	£10	4½	4½	9⅜ — 9⅝	..	4 12 4
Do. Second 6 % Pref.	£10	6	6	10⅛ — 10⅜	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord.	£5	10	10	8⅜ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	£5	7	7	8½ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	£100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	£5	5	5†	4½ — 4⅝	..	5 5 8
Do. 4½ % Cum. Pref.	£5	4½	4½	4½ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	£5	4½	4½	8½ — 4	..	5 12 6
Do. Do. 4 % Deb.	£100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	£5	5	4†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	£10	8	9	14½ — 16	..	5 12 6
Do. 6 % Cum. Pref.	£10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	+ ½	4 4 9
Do. 4½ % Second Deb.	£100	4½	4½	98 —100	..	4 10 0
County of London, Ord.	£10	6	6	10⅜ — 11	..	5 9 1
Do. 6 % Pref.	£10	6	6	11⅜ — 11⅝	..	5 3 2
Do. 4½ % Deb.	Stock	4½	4½	102 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	£5	Nil	6	4 — 4½ xd	..	8 8 7
Do. 6% Non-Cum. Pref.	£5	..	..	1⅜ — 2⅜	..	..
Do. 4½ % First Mort. Deb.	£100	4½	4½	80 — 83	−1	5 8 5
Folkestone	£5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	£5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	£100	4½	4½	90 — 92	..	4 17 10
Hove	£5	9	9†	7⅝ — 8	+ ⅛	5 12 6
Kensington & Knightsbridge, Ord	£5	9	8†	7½ — 7⅝	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78 xd	..	5 15 5
London Electric, Ord.	£5	2½	2½	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	£5	5	5	4⅝ — 5⅛	−⅛	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	£5	4	4†	3¼ — 3⅜	..	5 10 4
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 4⅜	−⅛	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	73½ — 81½	..	4 6 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	£100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	£10	6	6	9½ — 10½	..	5 14 3
Oxford	£5	7½	6†	5¾ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	£5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	£5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	£100	3½	3½	83½ — 85½	..	4 1 10
South London, Ord.	£4	8	8	2¼ — 3¼	..	7 7 8
Do. 5 % First Mort. Deb.	£100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref.	£1	7	7	1 1/16 — 1 1/8	..	5 17 11
Do. 4½ % First Deb. Stock	£100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	£5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb.	£100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	£5	10	10	8 — 8⅜	..	6 1 3
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 5⅛	+ ⅛	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	£5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	£5	8½	8½	7 — 7⅝	..	5 13 4
Do. 5 % Pref.	£5	5	5	4¼ — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	£100	5	5	91 — 98	..	5 7 6
Canadian Gen. El. Com.	$100	7	7	108 —112	..	6 5 0
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	£1	3	5	⅜ — 4⅜	..	6 3 1
Do. 5 % Deb.	£100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	£100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	£100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 1/16	..	Nil
Do. 6 % Pref.	£1	6	6	11/16 — ¾	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —101	..	4 19 0
Madras, Ord.	£5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	£100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	£..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	57 — 61 xd	..	6 11 2
Do. 7 % Cum. Pref.	$100	7	7	92 — 97	+2	7 4 4
Do. 5 % 1st Mort. Gold Bds.	£..	5	5	87 — 90	..	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	£100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power	$100	8	9†	210 —220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	£100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	5	5½	123 —127	−1	4 6 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99 —102	+1½	4 8 3
Toronto Power, 4½ % Deb.	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	£100	5	5	95½ — 92½	..	5 8 1
Victoria Falls Power, Pref.	£1	11¾d.	17⅞d.	11/16 — 12/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	£100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4	4½†	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 94½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	129 —132	..	6 1 3
Do. Collat. Trust	$1000	4	4	90 — 92	+1	4 7 0
Anglo-American Telegraph	Stock	3	3	60 — 63 xd	..	4 15 3
Do. 6 % Pref.	Do.	6	6	107½ —108½ xd	+ ½	5 10 6
Do. Def.	Do.	80/-	80/-	23½ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	£100	5	5	104 —106	..	4 15 3
Chili Telephone	£5	7	8	7 1/16 — 7 1/8	..	5 2 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	83 — 85	..	4 13 7
Cuba Telegraph	£10	6	6	8¾ — 9½	..	6 6 4
Do. 10 % Pref.	£10	10	10	15½ — 16½	..	5 19 4
Direct Spanish Telegraph, Ord.	£5	4	4†	8¼ — 8½	..	5 6 8
Do. 10 % Cum. Pref.	£5	10	10	6¾ — 7¼	..	6 18 0
Direct United States Cable	£10	5	4	6¼ — 6½	+ ⅛	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	£100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	124½ —127½ xd	..	5 9 10
Do. 8½ % Pref. Stock	Do.	8½	8½	7 3/16 — 7 5/16 xd	+ ⅛	4 12 9
Do. 4 % Mort. Deb.	Do.	4	4	92 — 94	+1½	4 5 1
Eastern Extension	£10	7	7	11¾ — 12¾ xd	− ⅛	5 18 2
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	£5	4	4	99 — 101	+ ½	3 19 3
Globe Telegraph and Trust	£10	6	6†	10⅜ — 11½	..	5 8 9
Do. 6 % Pref.	£10	6	6	11¼ — 12⅜	− ⅛	4 14 1
Great Northern Telegraph	£10	18	20	30 — 32	..	6 5 0
Indo-European Telegraph	£5	13	13	55 — 57	..	5 14 0
Mackay Companies Common	$100	5	5	80 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	£1	20	..	3⅜ — 3⅝	+ 1/16	5 6 8
Do. 7½ % Cum. Partic. Pref.	£1	17	..	2⅝ — 2¾	..	5 8 9
Monte Video Telephone, Ord.	£1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	£1	5	5	⅞ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	£100	4½	4½	98½ — 99¼	+ 1	4 10 6
Oriental Telep. and Elec.	£1	8	10	13⅜ — 13⅝	..	5 8 6
Do. 6 % Cum. Pref.	£1	6	6	1⅛ — 1⅜	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	..	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	+ 1	4 1 8
Reuter's	£10	10	10	8¾ — 9¾	− ½	10 5 2
Submarine Cables Trust	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	+ ½	4 12 9
United River Plate Telephone	£5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	£5	5	5	5 — 5½	..	4 11 0
West Coast of America	£1	2½	..	1 1/16 — 1 1/8	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Brax. Sub. Tel.	£100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	£10	1½	1½	2⅛ — 2⅜	..	4 15 8
Do. 6 % Cum. 1st Pref.	£10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref.	£10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	£100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd.	£10	7	7†	12⅜ — 12⅞	− ⅛	5 8 9
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME,	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	$\frac{3}{16}$ — $\frac{5}{16}$	..	Nil
Do. 5 % Pref.	1	5	5	$\frac{29}{32}$ — $\frac{31}{32}$	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	8 — 10	..	..
Do. Do. Deferred ..	100	..	..	3¼ — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	..	7 6 4
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	..	5 7 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	78 — 77	..	5 17 0
Central London Railway, Ord.	100	3	3	75 — 77	..	3 18 0
Do. Gtd. Assented	100	..	..	80 — 82	+1	4 18 9
Do. Pref.	100	4	4	80 — 82	..	4 17 7
Do. Gtd. Assented	100	..	..	82 — 84	+1	4 15 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1908	100	5	5	99 —102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	+ ¼	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	$\frac{17}{32}$ — $\frac{35}{32}$	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	6⅜ — 7⅜	..	6 8 3
sle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 8
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	$\frac{29}{32}$ — $\frac{31}{32}$	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	$\frac{29}{32}$ — $\frac{31}{32}$	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	—2½	6 0 0
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb	100	4	4	56 — 60	—1	6 13 4
Metropolitan Railway Consol. ..	100	1⅞	1⅞	45⅜ — 46½	— ½	3 10 3
Do. Surplus Lands	100	2½	2½	61 — 63	..	4 7 4
Do. 3½ % Deb.	100	3½	3½	83 — 85 xd	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	78 — 80	..	4 6 5
Metropolitan District Ord. ..	100	Nil	Nil	32⅜ — 33½	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	..	$\frac{29}{32}$ — $\frac{31}{32}$	..	..
Do. 5 % Pref.	1	6	5	$\frac{31}{32}$ — 1⅛	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	$\frac{7}{8}$ — $\frac{9}{8}$	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	$\frac{31}{32}$ — 1	..	Nil
Do. "A"	1/-	4½	..	$\frac{29}{32}$ — $\frac{31}{32}$	—$\frac{1}{32}$	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	108 —110	..	5 9 1
Do. 4½ % Bonds	100	Nil	4½	98 —100	+2	4 10 0
Do. 6 % Income	100	3	6†	89½ — 90½	..	6 12 7
Yorkshire (West Riding), Ord.	5	..	..	$\frac{29}{32}$ — $\frac{31}{32}$	..	Nil
Do. 8 % Pref.	5	..	8†	33⅛ — 34½	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅜ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	— 1/16	6 3 11
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	96 — 98	+ ½	5 2 0
Auckland Trams, 5 % Deb. ..	100	5	5	99 —101	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	87 —89	..	6 14 10
Brisbane Trams Invts., Ord. ..	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	123 —128	+2	6 5 0
Do. Pref. Ord.	100	6	6	111 —116	+1	5 8 5
Do. 5 % Pref.	100	5	5	102½ —105½ xd	+1½	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 8
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1 1/16 — 1 3/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90¼ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	⅛ — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	$\frac{13}{32}$ — $\frac{17}{32}$	..	..
Do. Pref.	1	6	..	$\frac{29}{32}$ — 1⅛	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	4½d.	1⅛ — 1⅜	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4⅜ — 5⅝	..	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87½ — 90½	..	5 10 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 — 101	+ ½	4 19 0
Mexico Trams Com.	$100	7	7†	89 — 92 xd	..	7 12 2
Do. Gen. Con. 5 % Bonds ..	..	5	5	89 — 92	..	5 8 8
Do. 5 % Bonds	100	6	6	87 — 90	−2	6 18 4
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1⅛ — 1⅜	..	4 0 0
Do. 5 % 1st. Deb.	100	5	5	102½ —105½	..	4 14 9
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	— ½	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	+1	5 1 0
Do. 5 % Mort. Bonds ..	100	5	5	91½ — 93½	+ ½	5 7 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 101	..	4 19 9
Singapore Trams, 6 % Deb. ..	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅜ — 4⅝	..	7 3 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	+ ½	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	$\frac{3}{16}$ — $\frac{5}{16}$ xd	..	7 7 8
Do. 6 % Pref.	1	6	6	$\frac{29}{32}$ — $\frac{31}{32}$ xd	..	7 2 6
Babcock & Wilcox	1	28	16	29⅜ — 30½	—½	5 5 7
Do. Pref.	1	6	6	1½ — 1⅝	..	4 7 3
British Aluminium, Ord.	1	Nil	..	$\frac{3}{16}$ — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	$\frac{3}{16}$ — $\frac{5}{16}$	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7⅜ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref. ..	8	Nil	Nil	$\frac{3}{16}$ — $\frac{5}{16}$	..	Nil
Do. Deb...	100	4	4	64 — 68	−1	5 17 8
Do. 6 % Prior Lien	100	6	6	100 —103	+1	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	38 — 48	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅜ — 11⅜	+ ⅛	6 11 10
Do. Pref.	5	5	5	4 13/16 — 5 3/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	32⅜ — 33½	..	5 6 8
Do. Deb...	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	..	..	..	.. — ..	..	..
Do. Deb...	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	5/16 — 7/16	..	..
Do. Pref.	1	6	6	10/16 — 12/16	..	7 18 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3½	5	1⅛ — 1⅜	..	7 5 6
Do. Pref.	2	7	7	1⅞ — 2⅛	+ ⅛	6 11 9
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	5	6	9⅜ — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12 — 12⅜	..	5 17 8
Do. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb...	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11½ — 12½	+ ½	6 2 5
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction.. ..	12	17½	20	34½ — 36½ xd	..	6 11 7
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Williams & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/16 — 3/16	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1913.

ALTHOUGH the export total for the month of June—amounting to practically half a million pounds—was considerably lower than the figure recorded in the previous month, viz., £638,271, yet the general business of June (excluding telegraphic exports), reached a somewhat higher level.

Electrical machinery and battery exports improved, but cable exports fell away considerably, as also to a small extent did the telephonic and certain other sections.

The imports for the month, valued at £211,256, also show some falling off as compared with the May figures. In this case, decreases were fairly generally distributed, but most marked in the case of the machinery sections; exceptions to the rule, however, were telegraphic and telephonic imports, which added some £14,000 to the May total.

The re-exports reached £26,304, a figure which compares somewhat badly with the £34,569 recorded in the previous month.

India was our most prominent customer during the month, with Canada not far behind; South America, Australia, China and Japan were also well represented. Germany, as usual, was the leading importer into this country, and, amongst the others, Canada was represented for a considerable value.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,016	144	468	154	2,912	151	8,196	140	15	22	10	2,724	16,952
Germany	2,971	979	41	27	619	9	3,000	...	53	88	...	338	8,125
Netherlands, Java and Dutch Indies ...	778	1,229	93	11	...	24	834	...	12	52	121	827	3,981
Belgium	377	426	201	...	154	2	2,330	25	4	8	765	382	4,674
France	214	...	3,638	...	...	...	7,239	1,680	58	95	529	5,000	18,453
Portugal	257	249	...	...	...	...	203	15	78	13	428	56	1,299
Spain, Canary Isles and Spanish N. Africa...	2,412	2,426	140	82	275	290	7,313	34	29	171	90	7,047	20,309
Switzerland, Italy and Austria-Hungary ...	1,358	40	324	22	32	19	1,541	6	...	291	18	8,087	11,738
Greece, Roumania and Turkey	177	42	20	150	...	...	257	...	31	11	1,253	3,385	5,326
Channel Isles, Gibraltar, Malta and Cyprus...	61	457	33	224	...	115	215	...	32	22	75	377	1,611
U.S.A., Philippines, Cuba, &c.	504	...	153	...	35	22	861	...	... 25	...	...	37	1,637
Canada and Newfoundland	996	10,555	347	461	10	3,402	11,691	...	12,679	15	2,335	3,766	46,257
British West Indies and British Guiana ...	130	...	26	36	...	180	244	...	22	...	11	...	649
Mexico and Central America	2	38	11	...	...	...	4,770	...	...	...	42	256	5,119
Uruguay and Paraguay	131	128	5	163	...	18	48	...	195	120	61	111	980
Chile	152	...	...	65	...	208	3,570	2,620	184	22	855	9,326	17,002
Brazil	459	1,346	2,290	40	173	187	4,875	2,711	1,129	30	2,915	5,251	21,406
Argentina	3,808	2,941	673	1,034	615	584	17,048	5,266	1,732	119	7,417	235	41,472
Colombia, Venezuela, Ecuador and Bolivia...	294	157	74	69	38	...	1,080	5	50	...	129	...	1,896
Egypt, North Africa and Persia	1,837	144	173	99	801	70	2,602	50	... 90	38	207	503	6,614
British West Africa	20	518	75	27	58	...	49	...	203	...	179	76	1,205
Rhodesia, O.R.C. and Transvaal	2,148	60	398	938	...	556	6,251	...	192	...	5	104	10,652
Cape of Good Hope	2,372	1,091	322	1,631	18	1,477	2,647	69	1,749	5	3,613	2,335	17,329
Natal	786	5,170	611	388	203	214	1,164	57	107	...	148	94	8,942
Zanzibar, Brit. E. Africa, Mauritius & Aden	246	31	67	66	...	148	852	1,074	...	...	218	367	3,069
Azores, Madeira and Portuguese Africa ...	99	921	70	...	26	103	1,648	163	673	...	921	1,291	5,915
China and Siam	1,518	8,397	1,130	293	...	1,571	1,532	7	73	...	1,131	9,548	25,200
Japan and Korea	350	66	1,081	22	...	1,980	18,856	519	499	...	...	...	23,373
India	5,549	7,135	2,064	2,388	343	1,383	24,183	2,573	3,216	243	1,078	3,400	53,555
Ceylon	758	178	321	40	...	56	641	204	80	...	196	134	2,608
Straits Settlements, Fed. Malay States, Brit. Borneo and Sarawak	620	699	784	227	86	837	6,455	27	121	101	2,863	2,794	15,614
Hong Kong	814	1,216	37	...	...	431	541	...	22	...	204	10	3,275
West Australia	97	397	126	562	...	73	941	...	445	...	51	321	3,013
South Australia	501	942	623	343	...	109	714	1,440	44	...	342	...	5,058
Victoria	1,515	4,699	349	1,261	76	175	4,870	763	787	...	946	90	15,531
New South Wales	903	16,208	704	999	119	1,873	8,860	2,146	579	...	1,290	6,398	40,079
Queensland	549	137	44	38	...	209	6,091	98	5	...	6	200	7,377
Tasmania	36	38	...	...	...	...	...	...	...	...	9	...	83
New Zealand and Fiji Islands	994	3,950	801	966	42	732	4,230	678	427	...	9,364	433	22,617
Total, £	38,809	73,154	18,317	12,826	6,635	17,208	168,442	22,370	25,640	1,466	39,825	75,303	499,995

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	125	...	8	14	...	...	4,516	...	758	...	8,074	13,495
Germany	2,432	19,953	3,232	8,983	7,097	2,354	38,208	4,069	2,695	7,055	8,567	104,645
Holland	...	...	...	513	397	...	..	180	...	...	...	1,090
Belgium	1,723	6,187	152	131	21	2	3,559	185	297	276	5,033	17,566
France	188	800	1,270	362	199	722	2,514	250	166	3,755	1,338	11,564
Switzerland	649	198	36	5	2	433	2,519	251	...	64	124	4,281
Italy	88	3,160	10	...	4	...	940	...	...	...	141	4,343
Austria-Hungary	...	379	...	450	164	...	68	...	62	198	324	1,645
United States	4,411	787	1,394	3	186	46	7,611	21,582	309	338	8,554	45,221
Canada	180	...	...	...	...	8	...	...	...	...	6,622	6,810
Total, £	9,796	31,464	6,102	10,461	8,070	3,565	59,935	26,517	4,287	11,686	38,777	210,660

Additional imports: Spain, carbons, £596.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	12,823	2,203	...	1,660	230	...	8,343	...	75	698	272	26,304

TOTAL EXPORTS: £499,995. TOTAL RE-EXPORTS: £26,304. TOTAL IMPORTS: £211,256.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRIC STEEL FURNACES IN SHEFFIELD.

With Special Reference to Messrs. Darwin and Milner's Tool Steel Furnace.

The electric steel furnace appears at last to be emerging from the experimental stage in this country. In Scandinavia large furnaces of this type have been in operation for years past, but there the availability of cheap hydro-electric power has facilitated experiments on a large scale. As to the advantages of electric steel furnaces, *per se*, there can be no doubt. The crucial factor determining their use is purely commercial, and is the price at which electrical energy is available. In Norway hydro-electric power is available at 0·05d. per unit (£1·75 per KW.-year), but the largest power distribution companies in this country cannot supply energy at less than 0·33d. per unit (£12 per KW.-year), and even this tariff is only available to consumers offering a very large demand of exceptionally high load factor.

In Sheffield, the city to which we at present confine our attention, energy is supplied to electric steel furnaces at 0·6d. per unit, or alternatively at £4 per annum per K.V.A. demand + 0·25d. per unit consumed. The latter tariff enables a minimum price of 0·38d. per unit to be reached for demands of 100 per cent. load factor, but at 50 per cent. load factor—a figure which can hardly be exceeded as an annual average in steel furnaces operation—current costs 0·5d. per unit on the "demand" tariff. Unless the load factor exceeds 30 per cent. or 35 per cent., the flat rate is the more economical. These tariffs compare unfavourably with those operative in Scandinavia and other countries blessed with powerful waterfalls but, owing to their inherent merits, electric steel furnaces have made steady progress in Sheffield during the past three or four years, and the experience gained with them has been such that their use is now likely to extend rapidly.

At the present time, there are three steel furnaces supplied from the Corporation mains and a fourth equipment is in course of installation. In addition to these, there are electric steel furnaces owned by Messrs. Vicers and supplied from their own generating plant. Single-phase furnaces have been installed by Messrs. Edgar Allen and Messrs. Thos. Firth, and a two-phase furnace is about to be installed by Messrs. Keyser, Ellison & Co., of a type similar to that which has been in successful use by Messrs. Darwin and Milner for several years past and which is described in detail below.

From the description of the Sheffield electricity supply undertaking which recently appeared in these columns,* readers will remember that energy for power applications in this district was, until recently, supplied at 2,000 volts, 50 cycles, two-phase, but that 11,200-volt, 50-cycle, three-phase generation and distribution is now practised and will be continued in all extensions. The first electric steel furnaces in Sheffield were supplied through two-phase—one-phase motor-generators, the low-tension supply being at 28 cycles in Messrs. Allen's installation, and at even lower frequency in Messrs. Firth's plant. The demand of a steel furnace is too heavy to be carried unbalanced across one-phase of a two or three-phase system, hence motor-generators will, of necessity, continue to be used for single-phase furnaces in Sheffield. Messrs. Darwin & Milner's furnace, and that about to be installed by Messrs. Kayser, Ellison, are of a two-phase type, and are supplied in the first case by direct static transformation from the two-phase mains, and in the second case through Scott T-transformers from three-phase mains. In both cases, the furnaces are operated at 50 cycles; it is only in induction furnaces that this frequency is objectionably high and in the present cases, the only advantage of lower frequency would be slightly reduced transformer iron losses.

Messrs. Edgar Allen's electric furnace is chiefly used to prepare steel for casting and is never charged with cold metal. Messrs. Firth's furnace is frequently used to melt from scrap but its chief application is to the refining of metal previously melted in a Siemens furnace. The work which has been carried out in Messrs. Allen's and Firth's furnaces has been chiefly of an experimental and very varying nature—leading to the accumulation of a large mass of data not easily reducible to a form suitable for publication, but Messrs. Darwin & Milner have specialised in the electric-furnace manufacture of titanium and vanadium tool steels, and, by their courtesy, we are now able to publish the following particulars of their equipment, method of working and results obtained. In the latter connection, it must be emphasised that the data quoted below are actual average working results, as distinct from the unreliable figures obtained in preliminary experimental work such as the extraordinary "snap" data frequently advanced by furnace makers as capable of realisation under continuous working conditions.

The two-phase electric steel furnace used by Messrs. Darwin & Milner is the joint invention of Grönwall, Lindblad and Stalhane, and is exploited in this country by Messrs. Electro-Metals, Ltd. The external appearance of the furnace in use is shown in fig. 1. Referring to fig. 2,

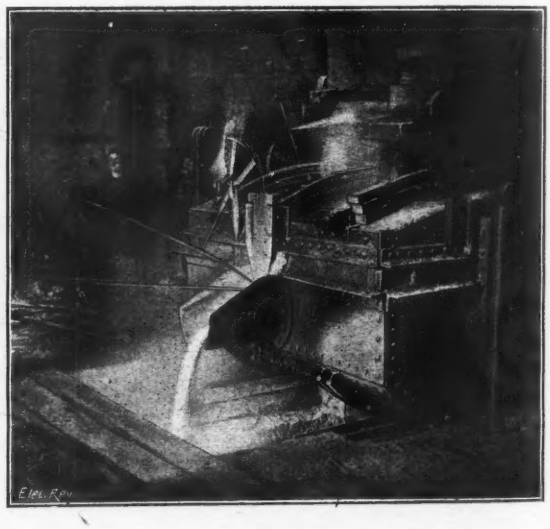


Fig. 1.—Electric Steel Furnace at Messrs. Darwin and Milner's Works, Sheffield.

which shows the furnace in side and front sectional elevation, it will be seen that the A and B phase arcs are struck in parallel, between the charge and adjustable vertical carbon electrodes. The neutral electrode, to which current flows through the charge, consists of a massive carbon block protected from the molten metal by the basic (dolomite and magnesite) lining of the furnace and attached to the neutral terminal casting by a special conducting cement.

The fact that two-phase current is used in the furnace enables supply to be taken from two-phase or three-phase networks (such as are now almost exclusively used for power distribution), through static transformers—without the intervention of motor-generators, which inevitably give trouble when supplying the irregular and heavy current demand of steel furnaces. During the melting of scrap metal, it is practically impossible to prevent frequent extinction of the arc due to falling about and subsidence of pieces of metal. The arcs being in parallel in the present furnace, the extinction of one arc merely reduces the instantaneous demand by 50 per cent., but, in a furnace with series arcs, the extinction of either throws the whole demand off the mains until both arcs are re-struck. This point is of great importance from the electricity supply point of view, and it is interesting to note that the present furnace alone, among those now connected to the Corporation mains in Sheffield, is permitted to start melting cold scrap during the evening peak load hours. From the furnace user's standpoint, parallel arcs offer the advantage of more rapid and economical melting.

A further advantage of the electrode arrangement shown in fig. 2 is that a vertical, as well as a horizontal, circulation of the molten metal is set up electromagnetically. Not only does this circulation ensure even and efficient heating of the

* Electrical Review, August 30th, 1912, pp. 324 *et seq.*

charge and prevent excessive local heating of the furnace lining, but it also expedites the desired chemical actions by bringing the whole of the charge successively into intimate contact with the refining slag. The basic lining covering the bottom electrode of the furnace is a secondary or electrolytic conductor (but possesses sufficient conductivity when cold to enable the furnace to be started up without difficulty), and the heat generated by the passage of current through it prevents solidification of more or less unrefined metal at the bottom of the bath, and thus enables the whole charge to be "teemed" in a chemically and physically uniform condition.

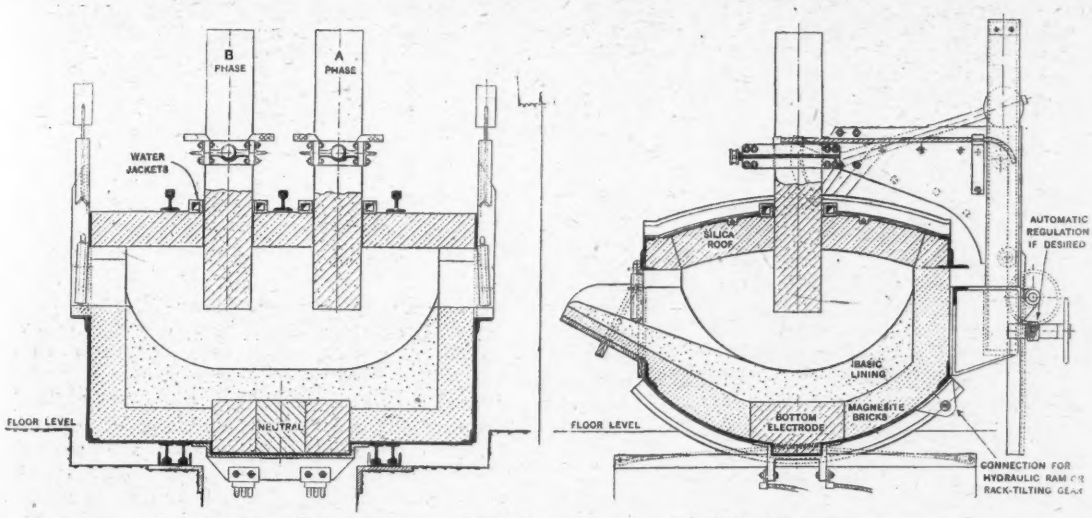


FIG. 2.—SECTIONAL ELEVATIONS OF TWO-PHASE ELECTRIC STEEL FURNACE AT SHEFFIELD.

In the present installation, two single-phase transformers are connected to the 2,000-volt, 50-cycle, two-phase power mains through a main oil switch which is provided with overload trip gear. Owing to exigencies of space, the transformers are placed in an underground pit, through which air is blown for cooling purposes; in a new installation, now under design, the transformers will be erected in a ventilated housing above the furnace level. Low-tension current at 55 volts (the transformer secondary voltage on open circuit is 62 volts) is carried through a flexible copper cable to four 3 in. × $\frac{3}{16}$ in. copper strips on the furnace. These strips are clasped round the electrodes by a chain band with bolt clips as clearly shown in fig. 2, and a special feature is that connection is made low down on the electrodes, thus reducing to a minimum C^2R loss in the latter. From the transformer terminals to the electrodes is about 10 ft.

The electrodes used are amorphous carbon rods 12 in. in diameter and of 1·57 sp. gr.; each is 5 ft. long (longer carbons would be used but for the limited headroom below the crane in the present foundry), weighs about 400 lb. and is provided with a screwed recess. Screwed carbon plugs are used to connect each new electrode to the stump of its predecessor; wastage is thus avoided and the screwed joint, being packed with a paste of graphite and tar, offers little contact resistance and runs quite cool in service.

As shown by fig. 2, each electrode is carried by an overhanging arm mounted on a vertical column provided with rack feed. In the present installation, the electrodes are adjusted by hand-operated worm and pinion gears (above which are mounted ammeters operated by series transformers in the respective phases of the furnace supply leads), but automatic motor regulation can be easily arranged.

In a new 3½-ton furnace, soon to be installed by Messrs. Darwin & Milner, the essential features of the above furnace will be retained, but various mechanical improvements will be incorporated and the external appearance of the furnace will be somewhat changed. The exact nature of the alterations in design may be seen by comparing figs. 2 and 3. Automatic is to be substituted for hand-regulation of the electrodes, and motor-tilting for the present hand-tilting gear.

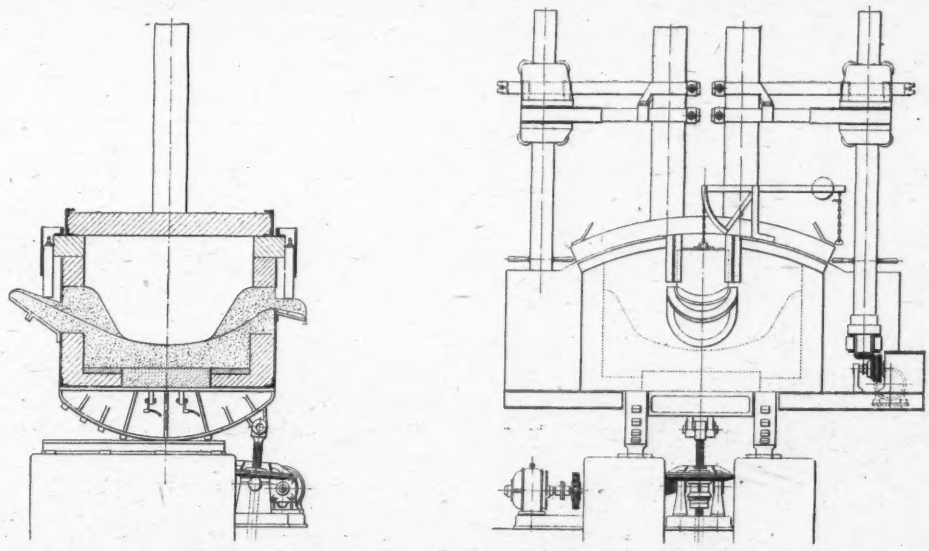


FIG. 3.—VIEWS OF NEW TWO-PHASE STEEL FURNACE WITH AUTOMATIC REGULATION AND MOTOR TILTING GEAR.

Manipulation and Performance of Furnace.—The present furnace—the first of its kind installed in this country—has been in use during the past 2½ years in the preparation of high grade alloy and carbon tool steels from rail end and similar scrap. The charging of the furnace with scrap and

a preliminary slag occupies about 30 minutes. Current is then switched on and maintained at from 4,000 to 4,500 amperes per phase for two or three hours, by which time the charge is completely melted. The oxidising or dephosphurising slag (containing scale, lime and fluorspar), which is added, removes carbon, silicon, manganese and phosphorus; a supplementary amount of the same material is added later if required. By the time the action of this slag is complete, the iron contains a large percentage of oxides, and could not be cast. To remove these oxides, together with sulphur and occluded gases, a deoxidising slag is introduced (lime, sand and fluorspar, with additions of powdered anthracite coal from time to time).

During the refining stage of the treatment, a current of 2,500 to 3,000 amperes per phase is used, and two or three hours after melting is complete, the impure scrap metal has been reduced to a steel containing not more than 0·025 per cent. phosphorus. At this stage a sample is cast, broken, examined for blowholes, and subjected to a rapid chemical analysis, the results of which enable carbon, ferro-vanadium and ferro-titanium, or other alloys, to be added to the furnace charge to bring it to the desired composition. As already explained, the electromagnetic circulation of the fluid metal ensures rapid and uniform absorption of the materials added.

During the preliminary stages of melting, the electrodes are under continual adjustment to compensate for the ever-varying level of the mixture of solid and molten iron below them, but as melting proceeds, the arcs become steady and quiet, and during the final de-oxidising stage of the refinement, heavy soot deposits collect round the electrode holes in the roof, and it is not easy to determine whether the furnace is working or idle.

The composition and temperature of the charge being correct, current is cut off and the furnace emptied into a ladle, which is then lifted over a trumpet feeding four 10-cwt. ingot moulds (see fig. 4). About 1 cwt. of metal remains in the trumpet and this is subsequently returned to the furnace

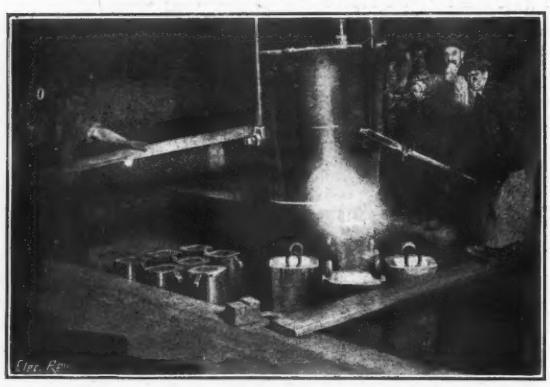


FIG. 4.—FILLING ½ TON INGOT MOULDS.

along with other scrap. The molten metal in the moulds is covered with a special composition powder, the effect of which is to prevent the formation of contraction "pipes" down the centres of the ingots during cooling.

Particulars relating to the melting and refining of a typical charge are as follows :—

Charge.—2 tons 2 cwt. 2 qrs. rail-end scrap containing C. 0·38 per cent.; S. 0·06 per cent.; P. 0·09 per cent. Charging commenced 1 p.m.; current on 1·25 p.m.; melted 3.30 p.m.; current off 5.50 p.m.; total time 4 hr. 50 min.

Yield—Ingots ... 2 tons 0 cwt. 0 qrs. : alloy steel containing S. 0·01%; P. 0·02%.
Scrap ... — 1 cwt. 0 qrs.;
Furnace loss — 1 cwt. 2 qrs.

Energy Used—

Melting ...	880 KW.-hrs.	= 415 KW.-hrs.	per ton of charge.
Dephosphurising	280 "	= 132 "	" "
Deoxidising ...	580 "	= 273 "	" "
Total ...	1,740 KW.-hrs.	= 820 KW.-hrs.	per ton of charge.
		= 870 KW.-hrs.	per ton of steel ingot.

Cost of electrical energy per ton of ingot (at 0·6d. per KW.-hr.) = £2 3s. 6d.

In another instance, 2 tons 1 cwt. of high-speed steel scrap was melted and deoxidised in three hours, by an energy expenditure of 520 units per ton of scrap.

As typical energy consumption for a 2½-ton furnace of this type may be taken :—

	Kw.-hrs. per ton of scrap.
Melting and first dephosphurising slag ...	525 to 545
Second dephosphurising slag	40 to 50
Desulphurising, deoxidising and (if necessary) re-carbonising	235 to 255
Total	800 to 850

The power factor of the furnace is about 89 or 90 per cent.

It will be seen that roughly 65 per cent. of the total energy consumption is required to melt scrap metal, (the duration of the melting period being as long as or longer than the refining period, and the current flowing being roughly twice as great in the former case). Under English conditions as to energy supply, melting can be more cheaply effected in open-hearth furnaces.

The minimum time interval from teem to teem is from 5½ to 6½ hours, distributed as follows :—

Fettling and recharging	0·5 hour
Melting (at 4,000-4,500 amperes per phase)...	2·0 to 3·0 hours
Slagging and skimming, &c.	0·5 hour
Refining (at 2,500-3,000 amperes per phase)...	2·5 hours

The staff required to operate such a furnace includes (apart from the supervising engineer and analyst), a melter and second hand, two men to operate electrode wheels (if these be hand regulated), and two ladle and pit men to assist in teeming and making up the ingot moulds, &c. It is imperative that the melter should be a first-class man; he must have had experience with open-hearth furnaces, and must be a better man than is required by the latter. The mistake has been made in the past of placing men who were simply electrical engineers in charge of electric steel furnaces. Actually, of course, the electrical features of the latter are very simple, and their manipulation calls for no particular electrical training. The electric steel furnace simply offers better facilities for the exercise of the steel maker's art.

The maintenance required by the present type of furnace includes: Electrode renewal, fettling, re-roofing and re-bottoming. The last two operations need only be carried out at considerable intervals, and their execution necessitates a temporary shut-down of the furnace and removal of its roof. The roof lining, which is the part most subject to wear in arc furnaces, is of acid silica bricks (basic material, though desirable, is unable to withstand the conditions encountered at the roof). The side walls are of magnesite brick and the bottom is a rammed mixture of dolomite and magnesite. The roof needs relining about once in 30 charges at a cost of £5, *i.e.*, roughly, 1s. 6d. per ton of yield. About 150 charges can be melted and refined before a new bottom is required; re-bottoming, which occupies about five days, is therefore necessary about once in two months if the furnace be worked double shift. The electrode consumption is about 25 lb. (costing 4s.) per ton of steel produced.

The total costs of production, excluding capital charges and the cost of scrap and alloys, may therefore be taken as :—

	Per ton of steel.
Electrodes	4s. 0d.
Lining, roof, fettling	6s. 0d.
Slag materials	2s. 6d.
Labour (assuming automatic electrode regulation)	6s. 0d.
Tools	1s. 0d.
Total—Materials and labour	19s. 6d.
Electrical energy, 825 KW.-hours at 6d. = £2 1 3	
Total—Materials, labour and energy	3 0 9

The prime cost of a 3½-ton furnace installed complete is about £2,200 (the greater part of this amount being on account of the necessary transformers and switchgear, &c.). The capital charges to be debited to the furnace when in service are practically limited to the interest on the initial outlay; there being no running machinery, the allowance to be made for depreciation is very low. The furnace represents but a small fraction of the total outlay and is kept in good condition by the regular maintenance charged for

above. Even allowing 10 per cent. for standing charges on £2,000, the total cost of production in a 2½-ton furnace averaging 2,200 tons output per annum is £3 2s. 6d. per ton, assuming current at 0·6d. per unit; or £2 15s. 8d., assuming current at 0·5d. per unit. This is a very favourable result considering the uniformity and high grade of the steel produced.

From the data given above, it will be seen that there is no difficulty in melting and refining an average of 18 or 20 charges per week (shut down from Saturday noon to Sunday night and working day and night for the rest of the week). Assuming 19 charges per week, there would be consumed per annum (19 × 52 × 2 × 825) = 1,630,000 KW.-hours. Taking the maximum demand to be 5,000 amperes per phase at 55 volts, or, say, 550 KW. from the supply mains, the above annual consumption would correspond to a load factor of about (1,630,000/550 × 8,760) = 34 per cent. The maximum possible load factor which can be realised with this type of furnace—assuming equal melting and refining periods and double current consumption during the former—is obviously 75 per cent., and it is anticipated that the load factor of the new furnace to be installed by Messrs. Darwin & Milner will approach 70 per cent. during each run and will average (on 20 charges per week), 70 × 20/28 = 50 per cent., in which case electrical energy will be available at 0·5d. per unit and the current cost per ton will be reduced to about 33s. per ton of steel (800 units at 0·5d.), and the total cost of production to about 44s. per ton.

So far as we know, the furnace illustrated in fig. 1 is the only one in this country used exclusively for tool steel manufacture, and 2½ years' experience with it has led to the conclusion that the best grades of steel can be prepared more easily and certainly by this than by any other process. Much experimental work has been carried out with this furnace, and the results obtained show that in it, inferior scrap can be converted to a tool steel or alloy steel of any desired composition, or the furnace may simply be used to prepare very hot and fluid metal, free from occluded gases, for use in making high-grade castings. Messrs. Darwin and Milner are now building a new electric steel foundry, in the equipment of which will be incorporated the results of the experience gained on their present equipment. In this new plant, even more favourable results are likely to be secured, and these we hope to report in due course. In conclusion, our thanks are due to Mr. P. R. Kuehnrich and to Mr. T. D. Robertson for their courteous assistance in compiling the above notes and data.

REVIEWS.

Electrical Engineering for Mechanical and Mining Engineers. By N. J. S. HEATHER, B.A. London: *Electrician* Printing and Publishing Co., Ltd. Price 9s. net.

This is really a work on electrical engineering designed for the purpose of explaining the elements of electricity to mechanical or mining engineers who, though fairly conversant with steam engineering, have little or no knowledge of electricity or its practical application for the transmission of power.

The work consists of 20 lectures, which were written for a special class of men in the South African gold mines, namely, the resident mechanical engineers, who, owing to the decision of the mine owners to abandon the direct production of power by steam, and to purchase electrical power, found it necessary to acquire an adequate knowledge of electrical engineering to enable them to retain their posts. A similar state of things is fast arising in our own country, and for this reason we think the work will be valuable to colliery engineers who may find themselves in a similar position. In the South African mines, as here, prior to the change from steam to electricity, the latter had only been used to a small extent, and the "electrician" occupied a comparatively unimportant position, being responsible to the resident mechanical engineer on each mine. As a consequence, the capabilities of some of the electricians were not of a high order, and the limitations in their responsibilities resulted in their being, as a class, somewhat deficient in the power of handling men, the very quality to which many of the mechanical engineers owed their positions. It appeared likely, therefore, that the gold-mining industry would find itself short of men capable of taking charge of the engineering department unless the mechanical engineers could adapt themselves to the new conditions. Hence the lectures.

No attempt is made in the work to deal with general electrical engineering, mechanical construction of apparatus or switchgear, or transmission and distribution systems, and in this respect it is, perhaps, a little disappointing; but we feel quite sure that when once the mining or mechanical engineer has mastered the intricacies of the "electric circuit," "resistance," "continuous and alternating currents," and those stumbling blocks so very difficult to get over, "three-phase currents," "periodicity," "wattless currents," "power factor," &c., he will have no difficulty in understanding the mechanical construction of the apparatus when it is before him. Everything is simply and clearly explained, often with arithmetical examples where calculations are involved, with the aid of numerous diagrams; mechanical analogies are frequently given the better to explain some law, and a number of questions to be answered are given at the end of each chapter. Dynamos, motors, transformers, polyphase systems, polyphase transformations, induction motors, and the effects of running under abnormal conditions are all dealt with in turn; and probably the only fault to be found with the work—and this only because it is designed for mining men—is that nothing is said about "earthing," which is becoming such an important factor in mining installations, at any rate in this country, and which we are convinced is very little understood. As it is, we have no hesitation in recommending the work as an introductory text-book to mechanical engineers who would like to know the ins and outs of electrical phenomena.

The Repayment of Local and Other Loans. Sinking Funds. By E. H. TURNER. London: Sherratt & Hughes. Price 21s. net.

This is a valuable though a somewhat unnecessarily ponderous work, with copious examples dealing with a variety of detail with the following aspects of the subject:—(1) Mathematical principles; (2) Methods of repayment of loan debt; (3) Sinking-fund problems—annual instalment, annual increment, date of borrowing and the redemption period; (4) Life of the asset, and its relation to the redemption period, and incidence of taxation; (5) the Equation of the period of repayment; and (6) the Equation of the incidence of taxation; the author's stated object being to render the work practically useful to those engaged in connection with the loan debt of public authorities and privately-owned undertakings.

The section on mathematical principles occupies over 80 pages, and is divided into "logarithms," "simple and compound interest," "compound interest as applied to a sum of money," "compound interest as applied to an annual or other periodic payment," "Thoman's logarithmic tables of compound interest and annuities," and "Standard calculation forms."

So far as the mathematical side of the subject is concerned, the reader who has already mastered the elements of interest and annuities certain will, of course, experience no difficulty in following the tenor of the author's way; but there are many to whom mathematical formulæ offer no attraction, and who do not exert themselves to obtain a passing knowledge of the science, which, though eternal, is comprehensible. For our part, we should have preferred the recognised notation. For instance, instead of $P = A/R^N$, we should use v^n, which represents the present value of 1 due in n years, or $(1 + i)^{-n}$. Again, we should express the present value of an annuity certain for n years by A_n, which is the result of $\frac{1 - v^n}{i}$ in preference to $P = A_y \left(\frac{R^N - 1}{R^N r}\right)$, but these are small matters, which do not detract from the value of the book.

Section II deals thoroughly with the repayment of loan debt from the usual points of view, viz., instalment method,

annuity method, the relation between the equal annual instalments of principal and interest combined and the sinking-fund instalment, the sinking-fund method, and the accumulative and non-accumulative sinking fund.

Adequately discussed, though we do not recognise any new feature, the sinking-fund problems section is full of interest.

The equation of the period of repayment of loans repayable at various dates which are required to be redeemed on one uniform date is treated from two standpoints : where the loans are authorised in respect of outlays of varying character, each having a different life in period of continuing utility and consequent repayment ; and where the necessity to find the equated period of repayment arises on the consolidation of existing loans.

In Chapter 33, the author discusses a comparison of the total annual loan charges to revenue or rate, before and after the equation of the period of repayment, showing the unequal incidence of taxation if the annual instalment and interest upon the total loan be spread equally over the equated period.

One of the most striking chapters in the book is that treating of the life or duration of the continuing utility of the asset created out of the loan, its relation to the redemption period, and the incidence of taxation. The difficult problem herein arises out of the periods allowed by Parliament (or other Government department concerned) for the repayment of loans authorised for different classes of outlay having longer or shorter lives, or periods of duration, and this variation in the life of the asset may in its turn react upon the period over which the loan is borrowed, or is repayable. This factor gives rise to the necessity to equate the period during which loans shall be repayable depending upon the life of the asset, and the consequent period of repayment, the date or dates of borrowing, whether in one year or spread over a period of years, and a combination of both periods, viz., of borrowing or repayment.

The Baudot Printing Telegraph System. By H. W. PENDRY. 1913. London : Whittaker & Co. Price 2s. 6d. net.

Until comparatively recently, the Baudot system was only employed in the British telegraphic service for communication with Paris. Within the last few years, however, its use has been extended to the inland circuits of this country, and the number of lines worked in this manner is rapidly increasing. The small book under review has been written to meet the requirements of telegraphists and others who, in consequence of this development, have been brought into contact with the new system, and desire to gain some knowledge of its method of working.

Owing to limitations of space, the descriptions of the different portions of the system are perforce somewhat brief. A reader who is in touch with the actual working of the instruments should not, however, have much difficulty in obtaining from the book a good general knowledge of the fundamental principles of the Baudot system.

The whole subject is covered, from a brief introductory sketch of the evolution of the Baudot to the latest developments. The final chapter contains some useful instructions on the adjustments of the different parts of the system, and the tracing of faults. There are, however, a few points which the author would be well advised to modify in a subsequent edition.

The mechanical action of the system is first described, and afterwards the electrical arrangements are dealt with. It would be much better for the student if detailed descriptions of the complicated mechanical devices were postponed till the broad outlines of the system had been given.

The description of the action of the distributor governor is by no means clear ; the mechanical terms introduced are very loosely employed. For instance :—

"It should be remembered also that the tendency towards an increase in the speed of rotation of the weight is restrained by the fact that the amount of centrifugal force required varies not in proportion to the increased speed, but as the square of that speed." And also—

"In order that the distributor speed shall remain constant, it is essential that the resistance shall uniformly balance the energy."

In the account of the motor-driven receiver the author says :—"Before proceeding further, it is considered advisable to furnish a brief outline of the principles upon which the motors are constructed and operate." This appears to be somewhat out of place in a book dealing specifically with a telegraphic system—the theory of the electric motor being much better studied in works specially devoted to electrical engineering. But the author proceeds to discuss, in a very scrappy manner and without any diagrams, the theory of the dynamo, and then remarks that continuous-current motors are constructed precisely on the plan of continuous-current dynamos, but by them electrical energy is converted into mechanical energy, the armature being urged to rotate by the mutual action of the magnetic field and the current in the armature coils. It is to be feared that the reader, having no preliminary knowledge of the subject, will not gain very much from this description.

The following sentence from the same section is rather curious :—"When the permanent magnets of the earlier electric machines (*sic*) gave place to electromagnets, and arranged to become self-exciting, the machines were termed dynamos." We are acquainted with live wires, but we should have liked to have seen these magnets in conference !

The section dealing with the distortion of the signals is also susceptible of considerable improvement. In this section the author says :—

"The impulses may be considered as transmitted by undulations of electromagnetic waves. When passing through a non-inductive resistance, such as that of an ordinary resistance box, the deteriorating influence experienced by an impulse is simply a falling-away of its magnitude, or attenuation, due to the ohmic resistance. But on all except very short lines the transmission waves suffer from the effects of capacity and inductance, the one producing a 'lead' and the other a 'lag' in the wave."

The writer is apparently unaware that a non-inductive resistance produces no attenuation in a varying current flowing through it. Attenuation is the action in a circuit which causes the current at the receiving end to be less than that at the sending end, and in a non-inductive resistance the strength of the current is the same at all parts of the circuit. Also, the effects of inductance in a telegraph line, and the capacity of the line to earth, are similar, each tending to retard the beginning of a signal, and to prolong its termination. The writer is apparently confusing these effects with those produced on the relations between the current and voltage in an alternating-current circuit by inductance and capacity in series with the line.

An account of the Post Office standard relay is given, and also, in the chapter on repeaters, a short description, with diagram, of an ordinary relay with a sounder in its local circuit ! In a book on the Baudot written for telegraphists in the British Post Office, these portions seem quite superfluous. The student of telegraphy, without any doubt, will know all about the standard relay and the simpler circuits in which it is used, before he ventures to attempt to study the theory of the Baudot system.

The foregoing criticisms are not intended to disparage the book, but to show how it could be made better and more useful than at present.

The points indicated are, however, mostly theoretical, and for practical men, in daily touch with the instruments themselves, the book should prove very useful. It is well printed on good paper, and the diagrams and illustrations are very clear.

Electric Massage.—After considering communications from the Commissioner of Police for the Metropolis, and representations from a number of societies, the Public Control Committee of the L.C.C. recommends that "establishments where massage, manicure, or electric treatment is carried on should be properly regulated." The Council asks Parliament to empower it to license or register and inspect such establishments.

L.C.C. Electrical Employés.—Following upon the objection raised by the Electrical Trades Union, last February, respecting the grading and pay of controller-repairers and light and power attendants, the Highways Committee now recommends the Council to refer the matter to the Rolling Stock Conciliation Board.

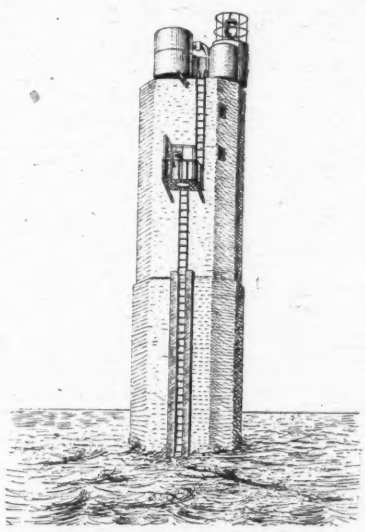
A TELEPHONE CALL OFFICE OUT AT SEA.

WITH a view to obtaining news of approaching mail boats during fog, a telephone has been fitted by the Guernsey Telephone Department on an unattended lighthouse on the Platte Fougère rock, 1¼ miles to the N.E. of the island of Guernsey. As described in our issue of October 14th, 1910, the fog signal on this lighthouse, operated electrically from the shore by means of a submarine cable, guides ships to the lighthouse, where they drop anchor until the lifting of the fog enables them to take the narrow channel leading to the harbours at St. Sampsons and St. Peter Port.

Few of the mail boats are fitted for wireless telegraphy, and it is believed the new telephone will prove a useful link and may prove invaluable in unforeseen emergencies at sea.

A mail-boat captain held up by fog could send off an officer to report his arrival at Platte Fougère, and thus allay anxiety in Guernsey as to his whereabouts. In many cases fogs are more or less local, and should the Channel be reported clear, the captain might find it possible to push forward.

Often the captain of a mail boat would not care to send off a boat to the lighthouse, owing to the delay should the fog suddenly lift. In such a case any local pilot in the



PLATTE FOUGERE LIGHTHOUSE.

vicinity would be expected to telephone news of the arrival of the mail boat. In return for this service, the pilots are given the free use of the telephone for their own purposes throughout the year.

The telephone is reached by climbing the lighthouse ladder of 42 rungs to the platform outside the doors. Before leaving the ladder a trap door has to be pushed open, and the pilot can then step on to the platform. Before the lighthouse door can be opened the trap door must be closed down. On opening the door an inner door, kept locked, is seen, and to the outside of this the telephone—an ordinary walnut-wood magneto call instrument (well paraffin-waxed)—is seen.

On ringing up, the light-keepers on the mainland are called, and can plug through to the Guernsey exchange system.

Besides three power cores of 19/17 copper, the submarine cable contains two 7/23 conductors, only one of which is available for telephone use. An earth return is, therefore, used with a transformer on shore to link up with the metallic-circuit system of Guernsey.

Even the single wire is not exclusively available for the telephone, and an automatic door switch ensures that when the telephone is not in use various lighthouse devices are connected in its place. It is, therefore, essential that after use the lighthouse door shall be properly closed, and to guard against forgetfulness, it is arranged so that the pilot using the telephone cannot lift the trap door to reach the ladder until the light-house door is first completely closed.

Speaking is good, even when during fog 18 E.H.P. is being transmitted by the power cores of the same cable (three-phase alternating, neutral point not earthed).

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NICARAGUA.—The Government has passed a decree providing that every Customs entry and Consular invoice required therewith must give particulars of the contents of each parcel, and must indicate the gross weight, the net weight, and the value of the various articles. From the date of this decree, a copy of the invoice must be presented with the entry. For the purposes of the decree, gross weight is understood to mean the weight of the goods with all containers, packing, coverings, receptacles, wrappings, &c., interior, exterior or immediate, in which the goods are contained or packed on shipment. The net weight does not include any *exterior* packing, covering, receptacle, &c.; but it does include all interior or immediate receptacles, including cardboard, paper, wood or other materials to which the articles may be attached. Straw and other similar materials placed for protective purposes between the outer container and the immediate receptacles of the goods are not included in the net weight. Weights must be expressed in kilogrammes or fractions thereof. The value of the goods to be declared in the entry and in the Consular invoice is their wholesale price in the principal markets of the country from which they are exported, when packed and ready for shipment (including the value of all boxes, crates, sacks, packing and containers of all kinds, and other costs and expenses incidental to the preparation of the goods for shipment); maritime freight, insurance, export duties, Consular fees and buyers' commissions are not included. The value of the goods is to be expressed in the currency of the exporting country.

SWITZERLAND.—The Customs authorities have decided that insulating tubes of paper or paper pulp, with sheath of common metal, are to be dutiable at the rate of 12 fr. per 100 kilogs.

HONDURAS.—The Government has passed a decree imposing a surtax of 5 per cent. on all imports into the country. The decree is to come into force on August 1st.

NEW ZEALAND.—The Customs authorities have issued the following decisions as to the duties to be levied on certain imported goods; the rates given are in every case those under the preferential tariff for British goods:—

Insulator bolts, swan-necked ...	... Free
Contact makers	... 20 % ad val.

PERU.—The Board of Trade has received a copy of a decree of the Peruvian Government which, in view of the early opening of the Panama Canal, lays down certain provisions designed to encourage the use of the ports of Paita, Callao and Mollendo for the warehousing of goods destined for re-exportation from those ports to other countries.

In the case of goods shipped to the three ports in question, Peruvian Consuls are to legalise, free of charge, the four copies of the Consular invoice which are required under the Peruvian Consular Regulations in respect of all goods shipped to Peruvian ports when the shipper declares that the goods are to be re-exported from the port of destination to another country. If the shipper does not make such declaration, the consignees of the goods shall be entitled to receive a refund of the Consular fees paid for the legalisation of the invoices if the goods, after being warehoused in the Customs house of one of the three ports, are subsequently re-exported to a foreign country. The charge for the warehousing of goods in transit for foreign countries at these three ports is to be at the rate of ½ per cent. per month, as against 1 per cent. otherwise for the first month, and ⅔ per cent. for each succeeding month.

As regards goods imported at Paita, Callao and Mollendo, and deposited in Customs warehouse under re-export declaration, the Consular fee for the legalisation of the invoices, as also warehousing charges at the full rate, will be payable if the consignee subsequently decides to clear them for consumption in Peru.

Educational Notes.—The new buildings for the School of Architecture at University College are approaching completion, and will be ready for the opening of the new session in October. They provide accommodation for one hundred students.

NORTHAMPTON INSTITUTE.—The arrangements of the courses for next session are announced in our advertisement pages to-day.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 235, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,585. "Dynamo-electric machines." BROLT, LTD., B. BROOKS and W. HOLT. July 7th. (Complete.)

15,587. "Sparking plugs." J. H. RUNBÅKEN. July 7th.

15,607. "Adjustable telephone arms." M. J. D. CARTER. July 7th.

15,636. "Magnetos." H. FORD. July 7th.

15,642. "Electric switches mechanically controlled from a distance." F. HODGSON. July 7th.

15,643. "Electric lighting control systems." F. HODGSON. July 7th.

15,644. "Incandescent electric lamps and their fittings." F. HODGSON. July 7th.

15,648. "Electrical devices for operating door sashes of automobiles and other carriages." J. F. P. DE LA RIBOISIERE. (Convention date, July 9th, 1912, France.) July 7th. (Complete.)

15,658. "Electric railways." C. M. WHITE. (M. E. Sturgess, United States.) July 7th. (Complete.)

15,673. "Wireless telegraph transmitter." J. G. BALSILLIE. (Convention date, September 23rd, 1912, Australia.) July 7th. (Complete.)

15,674. "Wireless telegraph receivers." J. G. BALSILLIE. (Convention date, September 23rd, 1912, Australia.) July 7th. (Complete.)

15,675. "Apparatus for checking any suitable predetermined excess number of calls at a telephone call-box or other place." J. PINTER. (Convention date, July 13th, 1912, Hungary.) July 7th. (Complete.)

15,682. "Electric control of electric motors." OTIS ELEVATOR CO., LTD. (Otis Elevator Co. Incorporated United States.) (Addition to 3,249/13.) July 7th. (Complete.)

15,686. "Variable-speed dynamo-electric machines." B. BROOKS and W. HOLT. July 8th.

15,696. "Method for aerial signalling and intercommunication with wireless telegraphy." G. H. JONES and L. V. HARBOR. July 8th.

15,697. "Dynamo-electric machines." B. BROOKS and W. HOLT. July 8th.

15,698. "Battery lamps." A. F. HAWDON. July 8th.

15,719. "Storage battery grids." E. F. WACKWITZ. (Convention date, July 8th, 1912, United States.) July 8th. (Complete.)

15,729. "Means for and methods of changing the frequency of alternating electric currents." A. M. TAYLOR. (Addition to 8,853, 1911.) July 8th.

15,733. "Electrically-operated piano-players." C. YOULDON and C. A. YOULDON. July 8th.

15,739. "Transformation and distribution of electric currents for lighting and other purposes." D. SUCHOSTAWER and J. O. OXLEY. July 8th.

15,748. "Telephone systems." W. D. DERRIMAN. (J. B. Russel.) July 8th. (Complete.)

15,760. "Electrical fuses of the plug type." H. T. PAISTE. July 8th. (Complete.)

15,769. "Systems for supplying from high-pressure mains continuous current at a lower pressure." E. A. GRAHAM and W. J. RICKETS. July 8th. (Complete.)

15,783. "Sounding transmitting apparatus." W. H. DERRIMAN. (Automatic Enunciator Co., United States.) July 8th. (Complete.)

15,797. "Telephone systems." L. W. BANNEHR. July 9th.

15,811. "Base-plate for electrical measuring instruments." LANDIS AND GYR, G.M.B.H. (Convention date, July 12th, 1912, Germany.) July 9th. (Complete.)

15,818. "Reversible variable-speed electric motors." L. SATCHWELL, C. WALLBRIDGE and J. ROSS, JUN. July 9th.

15,824. "Manufacture of electric glow lamps." WOLFRAM LAMPEN AKT.-GES. (Convention date, July 17th, 1912, Germany.) July 9th. (Complete.)

15,826. "Safety lifeguards for attaching to motor-omnibuses, electric tramcars, taxicabs, and other like vehicles." E. W. EVANS. July 9th.

15,828. "Telephony." S. G. BROWN. July 9th.

15,869. "Method of indirect excitation for oscillatory circuits." E. GIRARDEAU. (Divided application on 11,703, 1912, May 16th.) (Convention date May 17th, 1911, Germany.) July 9th. (Complete.)

15,870. "Electric fans." B. FAZAN. July 9th.

15,875. "Arrangement for starting groups of electrical machines consisting of a synchronous machine and an asynchronous machine connected in cascade with it." ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI SOC. ANON. (Convention date, March 21st, 1913, Belgium). July 9th. (Complete.)

15,879. "Heating by electricity." P. R. WILDE. July 9th.

15,891. "Devices for cleaning the globes of electric arc lamps and the like." R. L. IRELAND. July 10th.

15,900. "Electric igniting device." E. V. JONES. July 10th.

15,909. "Dry batteries." SAKIZO YAI. July 10th. (Complete.)

15,929. "Manufacture of drawn tungsten and the like wire." C. GLADITZ. July 10th.

15,950. "Automatic breakers for electric circuits." A. POLLAK. (Convention date, July 18th, 1912, United States.) July 10th. (Complete.)

15,951. "Safety devices for electric conductors." G. GILES. (Addition to 4,997/09; Convention date, July 20th, 1912, Switzerland.) July 10th. (Complete.)

15,968. "Contact devices for electrical testing purposes." EVERSHED AND VIGNOLES, LTD., W. CLARK and G. SENIOR. July 10th.

15,974. "Sparking plugs for internal-combustion engines." ELECTRIC IGNITION CO. (1913), LTD., and A. COX. July 11th.

15,975. "Insulating or the like slabs." J. A. TORPEY. July 11th.

15,980. "Thermo-electric batteries and the like." C. D. MCCOURT. July 11th.

16,011. "Electric transformer furnace." J. BALLY. (Convention date, July 12th, 1912, France.) July 11th. (Complete.)

16,015. "Dynamo-electric machines." H. LUCAS and H. E. MOORE. July 11th. (Complete.)

16,027. "Alkaline electric accumulators." E. FOSS, F. HARRIS and B. W. PARKER. July 11th.

16,034. "Electromagnetic balances." SOC. DES ETABLISSEMENTS GAUMONT. (Convention date, July 29th, 1912, France.) July 11th. (Complete.)

16,040. "Electric heating." A. F. BERRY. July 11th.

16,048. "Electrolytic diaphragms." H. A. WAGNER. July 11th. (Complete.)

16,058. "Incandescent bulbs in electric safety." F. FAERBER. July 11th. (Complete.)

16,066. "Process of producing filaments or wire wolfram and wolfram alloy." E. A. KRUGER. July 11th. (Complete.)

16,078. "Sparking plugs." F. A. L. JOHNSON. July 12th.

16,081. "Expanding pendant for gas or electric light fittings." E. PHILLIPS. July 12th.

16,092. "Thermostatic control of electric currents." E. G. BYNG and C. H. ARCHER. July 12th.

16,103. "Antiseptic telephone receiver." F. Robinson. July 12th.

16,113. "Electric motors suitable for display advertising devices and the like." A. C. HARRIS. (Addition to 19,268/11). July 12th.

16,123. "Means for completing an electric circuit when a predetermined temperature is reached, applicable for actuating fire alarms and for other purposes." J. MATLEY and C. RUSSEL. July 12th.

16,126. "Electro-magnetic receivers." T. C. COYKENDALL. July 12th. (Complete.)

16,128. "Money boxes for apparatus such as prepayment telephones, coin-freed gas meters or the like." H. G. C. FAIRWEATHER. (Ges. für Elektrische Industrie Akt.-Ges., Austria.) July 12th. (Complete.)

16,150. "Automatic telephone register." A. W. CRAWFORD. July 12th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 235, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

MACHINE FOR ELECTRIC BRAZING, SOLDERING OR WELDING FOR UNITING BRAKE STRIPS TO WHEEL RIMS OR BEADS TO THEIR RIMS. C. H. Apsey. 29,120. December 27th. (June 27th, 1912.)

1912.

APPARATUS FOR ACTUATING CONDUIT COVERS AND COLLECTOR PLOUGHS OF ELECTRIC RAILWAYS. D. Samaia. 9,637. April 23rd. (Patent of Addition not granted.)

IGNITION SYSTEMS. C. F. Kettering. 12,047. May 21st. (May 22nd, 1911.)

TELEPHONE EXCHANGE SYSTEMS. W. Aitken. (Automatic Electric Co. partly.) 14,318. June 19th.

ELECTRICALLY-CONTROLLED POINT OR SWITCH OPERATING MECHANISM FOR RAILWAYS AND THE LIKE. R. V. Cheatham. 14,739. June 24th. (June 22nd, 1911.)

RECEIVERS FOR PRINTING TELEGRAPH SYSTEMS. G. S. Hiltz. 14,857. June 25th.

CALL-DISTRIBUTING TELEPHONE SYSTEMS. H. P. Clausen. 14,945. June 26th. (June 26th, 1911.)

ELECTRIC OVENS. H. T. Harrison. 15,035. June 27th.

TELEPHONE SYSTEMS. A. E. Keith. 15,072. June 27th. (June 28th, 1911.)

ELECTRIC LAMPS USING INCANDESCENCE FILAMENTS OF THE SECOND CLASS. A. Clarke. 15,127. June 28th.

STORAGE BATTERIES. E. Sokal. 15,404. July 2nd.

SUPPORTING DEVICES FOR FILAMENTS OR WIRES IN INCANDESCENT METAL-FILAMENT LAMPS. Julius Pintsch Akt.-Ges. 15,485. July 2nd. (November 18th, 1911.)

ELECTRIC AERIAL RAIL OR ROPE WAYS. Elektro Motoren Werke Hermann Gradenwitz. 15,930. July 8th. (July 8th, 1911. Addition to and divided application on No. 12,833 of 1912, May 31st.)

APPLIANCES OR MEANS FOR MOUNTING INCANDESCENCE ELECTRIC LAMPS AND THE MANUFACTURE THEREOF. A. W. Beuttell. 16,307. July 12th.

INSULATING AND TENSIONING DEVICE FOR ELECTRIC CABLES. I. Porak. 16,671. July 17th. (April 4th, 1912.)

HOLDERS FOR INVERTED GLOBES OR SHADES OF GAS AND OTHER LIGHTS. A. Rose, W. Bellamy and J. Dolphin. 17,102. July 23rd.

ELECTRIC FLOOR LAMPS. G. Maurice and L. G. Byng. 17,247. July 24th.

AUTOMATIC TELEPHONE EXCHANGE SWITCHES AND CONTROLLING CIRCUITS THEREFOR. Western Electric Co. (Western Electric Co.) 17,858. August 1st.

ELECTRIC COUPLINGS OR CONNECTORS. J. Wilkie. 18,060. August 6th. (Patent of Addition not granted.)

COMBINED PLUG AND SWITCH FOR ELECTRIC CIRCUITS. W. R. Lambert. 18,275. August 8th.

ELECTRIC RECTIFYING APPARATUS. British Thomson-Houston Co. (General Electric Co.) 18,747. August 15th.

HOLDERS FOR TELEPHONES. G. B. Stern. 21,725. September 24th.

COMBINED ELECTRIC INDICATORS AND STEAM FLOW METERS. British Thomson-Houston Co., Ltd. (General Electric Co.) 22,262. September 30th.

MINE EXPLODERS. Sterling Telephone and Electric Co, Ltd. (Schaffler & Co.) 22,450. October 2nd. (Addition to No. 27,318a of 1906.)

SWITCHES FOR ELECTRO-MAGNETIC CLUTCHES IN MACHINES WITH REVERSAL OF MOTION. E. C. R. Marks. ("Vulkan" Maschinen Fabriks Akt.-Ges.) 23,150. October 10th.

BRUSH-RAISING MECHANISM FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co., Ltd., and F. P. Whitaker. 25,704. November 8th.

FILAMENT CARRIERS FOR ELECTRIC INCANDESCENT LAMPS. Westinghouse Metallfaden Gluhlampenfabrik Ges. 26,288. November 15th. (November 20th, 1911.)

"Switching" Certificates.—The energy displayed by Messrs. A. P. Lundberg & Sons in advancing the cause of improved controls for lighting circuits is remarkable. The latest efforts of the firm in this direction consist in instituting periodical examinations in "Electric Light Switching." A series of questions is based on the subject as dealt with in the firm's booklet "Lektrik Lighting Connections"; these may be worked out at home by anyone who cares to do so, and may then be submitted to Messrs. Lundberg for examination without charge. Though reference to the above (or any other) book is not barred, the questions are of such a nature that they cannot be answered directly from the book. In other words, they are a test that the examinee can see between and beyond the actual published examples of controls; and practically every answer involves the sketching of a more or less original connection diagram. Certificates and money prizes will be awarded to the senders of satisfactory papers, and those who wish to test their knowledge of the subject of lighting controls should apply to the firm at 477-489, Liverpool Road, London, N., for one of their "Electric Light Switching-Competition Circulars." We have one of these in front of us, and a glance through the questions conclusively proves that there is much more in switching than meets the eye. We note, for example, questions relating to the control of lights on warships and in railway trains. The idea is a good one, and should effectively stimulate study of this important branch of wiring work.